OKI

MICROLINE 590/591 PRINTER

MAINTENANCE MANUAL

PREFACE

This maintenance manual describes how to maintain the Microline 590/591 printer in the field.

This manual is for customer engineers.

For further information, refer to the Users Manual for handling or operating the equipment.

MICROLINE 590/591
Maintenance Manual

M-521041 1A

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1. CONFIGURATION

1. CONFIGURATION

1.1 Standard Printer Configuration

ML590/591 consists of the following assemblies:

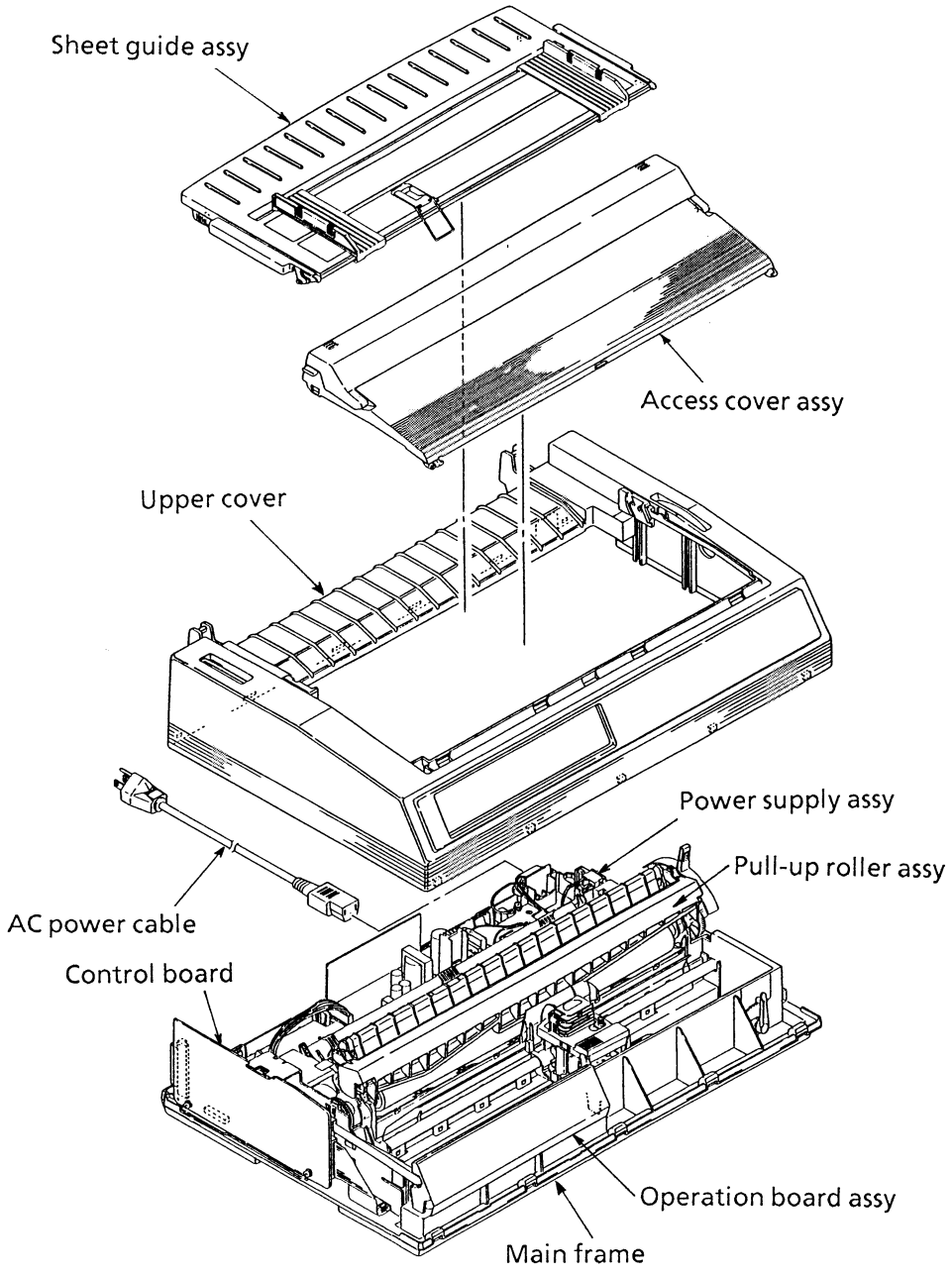
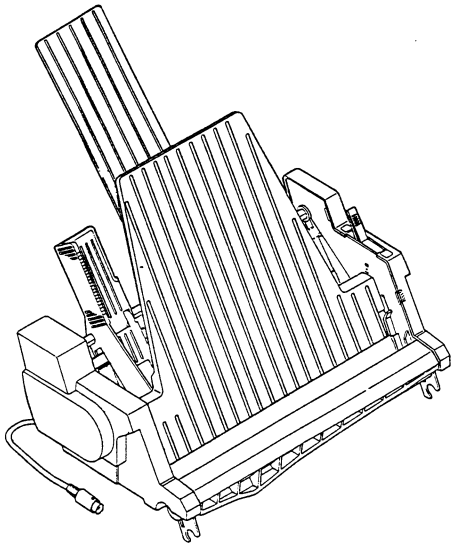


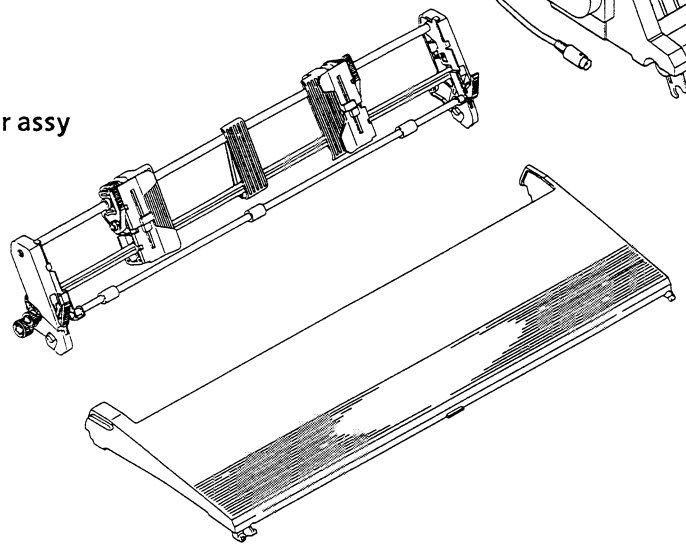
Figure 1-1 Configuration

1.2 Options

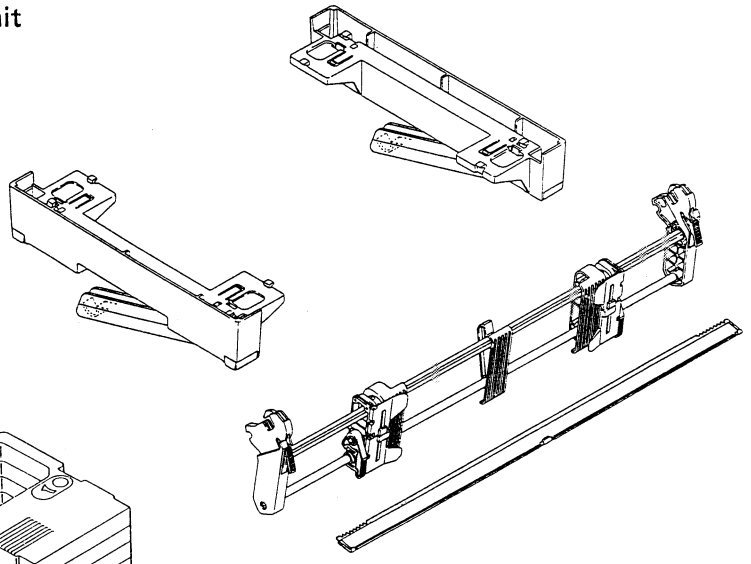
(1) Single bin cut sheet feeder unit (CSF)
(Narrow and wide versions available)



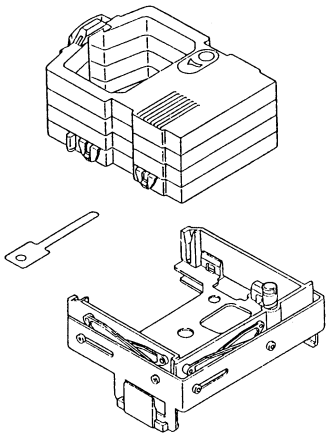
(2) Pull-tractor assy



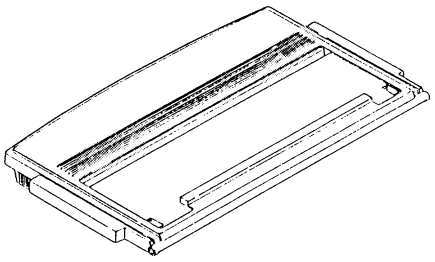
(3) Bottom push tractor unit

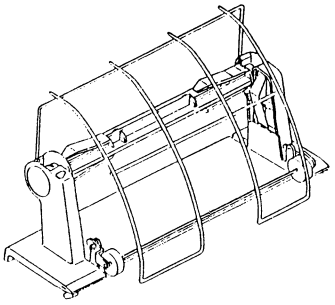


(4) Colour Kit



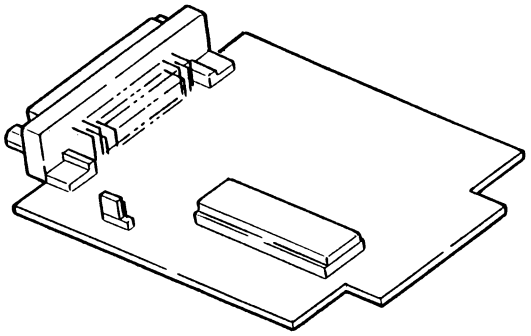
(5) Roll paper stand (ML590 only)





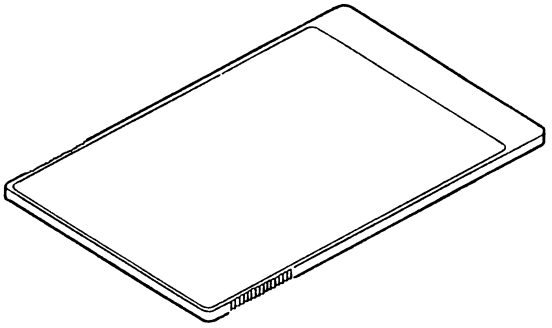
(6) Serial I/F

- RS232C
- RS422A
- Current Loop



(7) IC Card

- Blank card for font
- RAM card (32KB)
  Note: The same one as Ram card for ML 390/1.



2. INSTALLATION PROCEDURE

2. INSTALLATION PROCEDURE

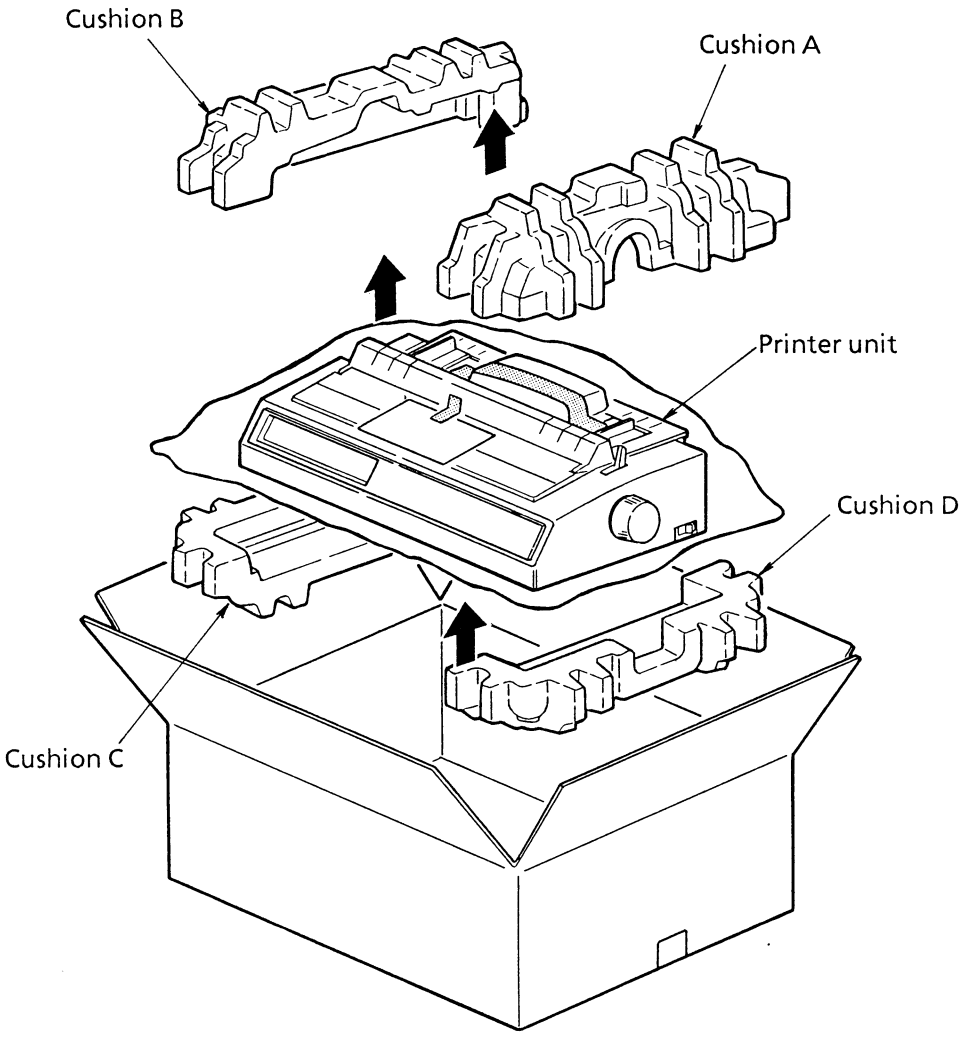
2.1 Unpacking

2.1.1 Unpacking the packing box

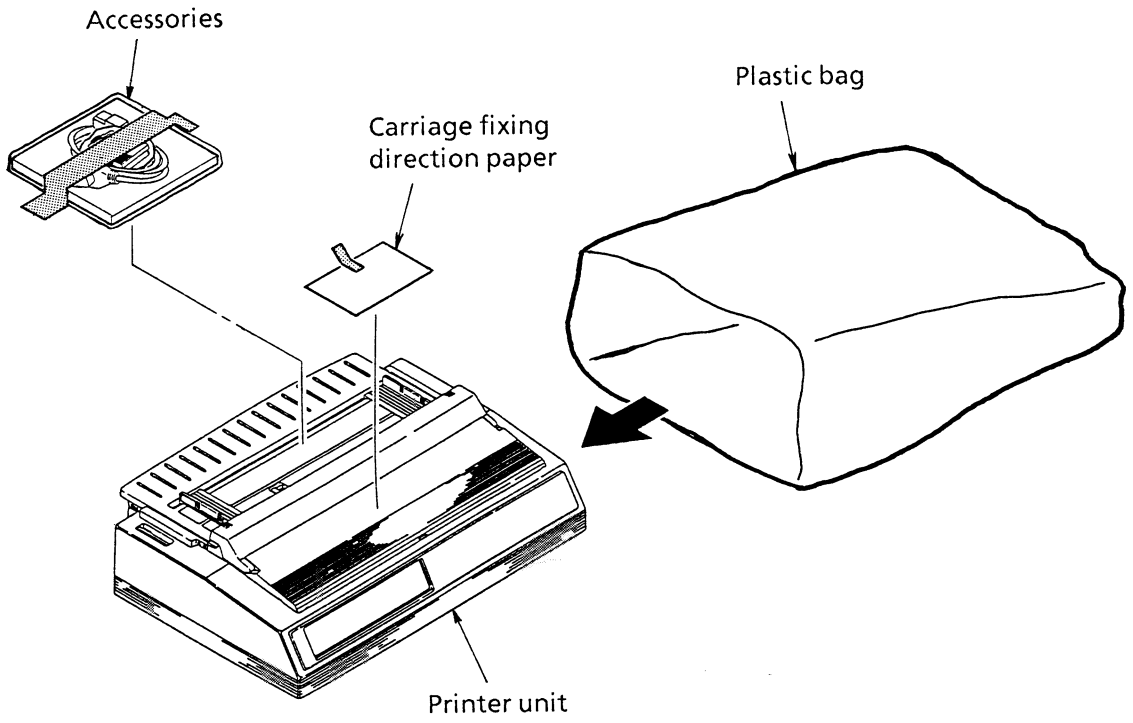
- Printer unit

  (1) NG

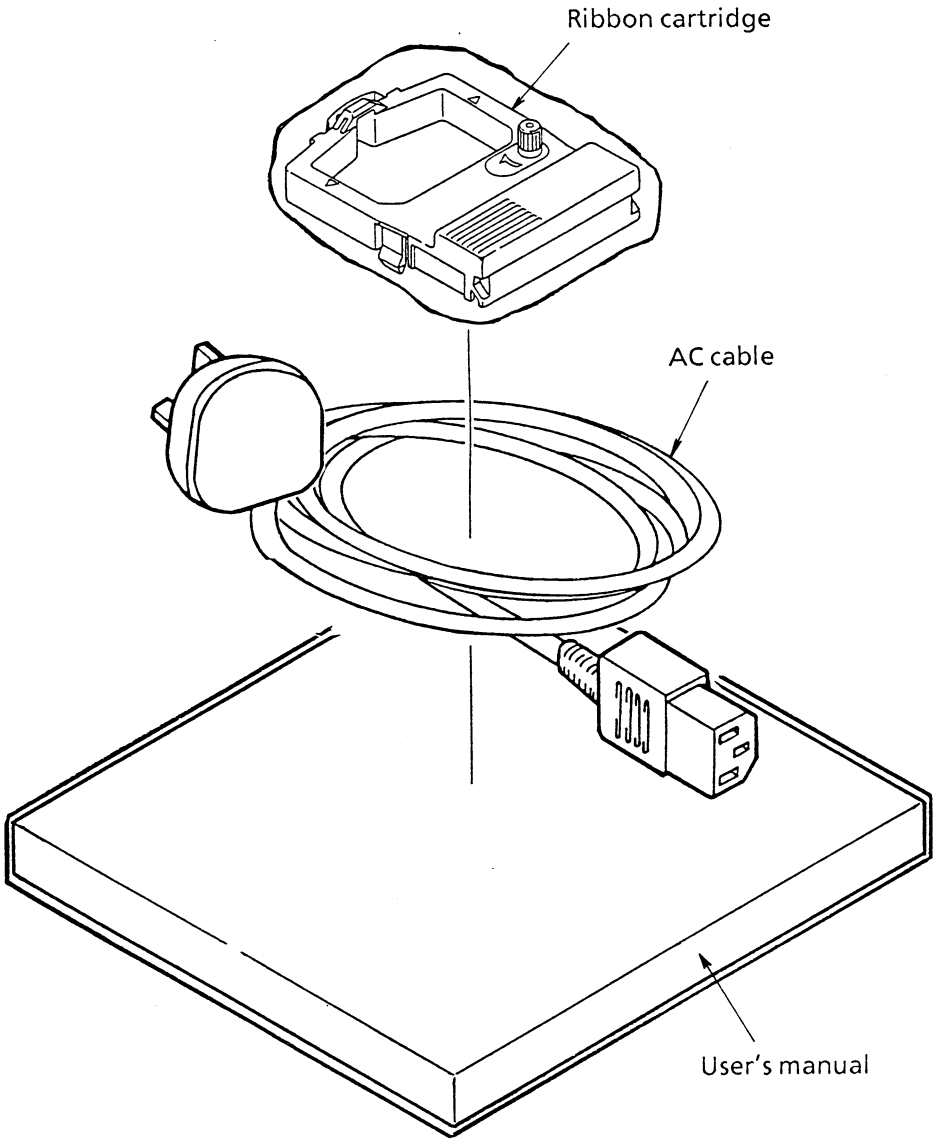
  Pending



2.1.2 Unpacking the printer unit



2.1.3 Unpacking the accessories



2.2 Installation (For details, refer to the Setup Guide.)

2.2.1 Precautions for installation

When installing the printer, observe the following precautions:

(1) **Do not install the printer in the following places:**

a) Place exposed to direct sunlight

b) Place with great fluctuations in temperature

c) Place exposed to outdoor wind

d) Dusty/Dirty environment

e) Near a door

f) Too near an air conditioner

g) Place subject to heavy vibrations

(2) **Adjust the temperature and humidity of the installation site as follows:**

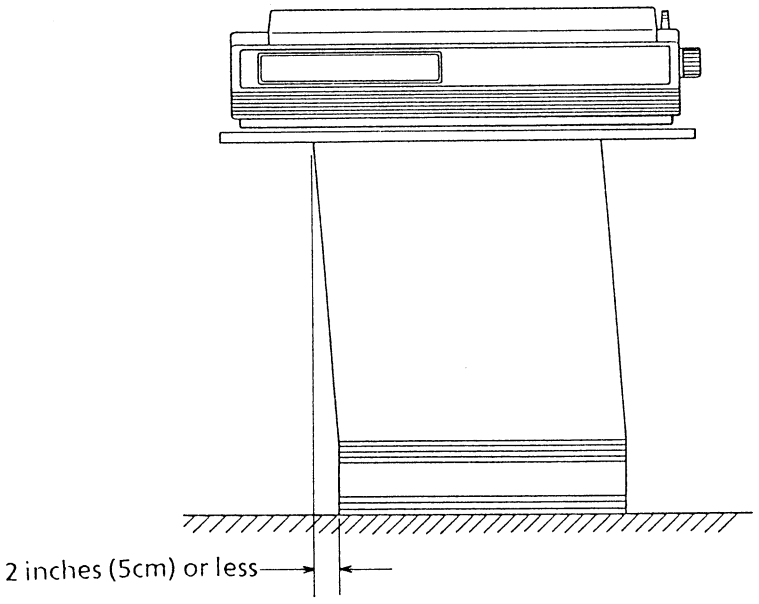
Temperature: 41°F to 95°F(5°C to 35°C)

Humidity: 30%RH to 85% RH

(3) **To install the printer and printing paper, observe the following procedure:**

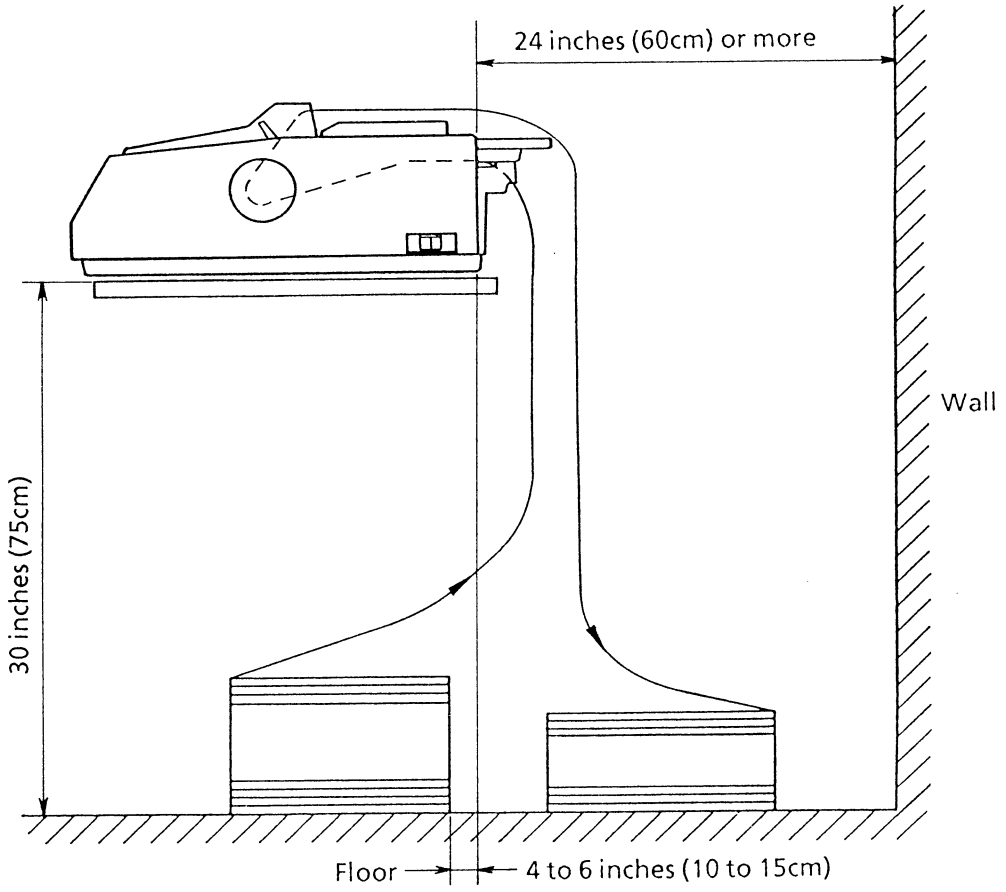
a) Adjust the height of the desk on which to place the printer to 30 inches (75 cm) as a standard.

b) Set the printing paper on the floor below the printer so that it may be fed into the printer without skewing from the feeding path by more than 2 inches (5 cm).



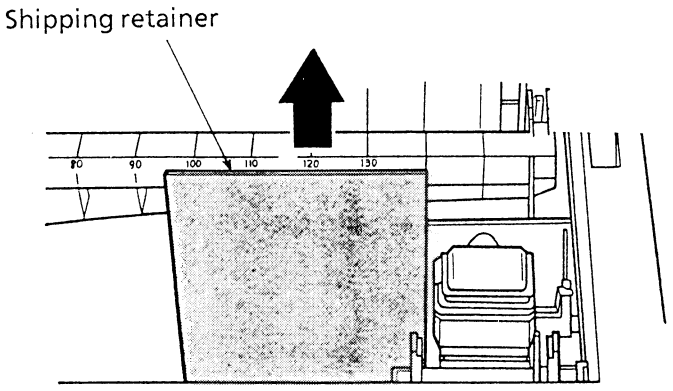
c) Align the rear section of the printer with the rear edge of the desk. Keep a distance of 24 inches (60 cm) or more between the rear section of the printer unit and the wall to provide a space for printed paper being fed out.

d) Keep a distance of 4 to 6 inches (10 to 15 cm) or more between the unprinted paper fed into the printer and the printed paper. If the paper going in one direction interferes with the paper going the other way, they may jam inside the printer.


24 inches (60cm) or more
Wall
30 inches (75cm)
Floor
4 to 6 inches (10 to 15cm)

2.2.2 Removing the shipping retainer

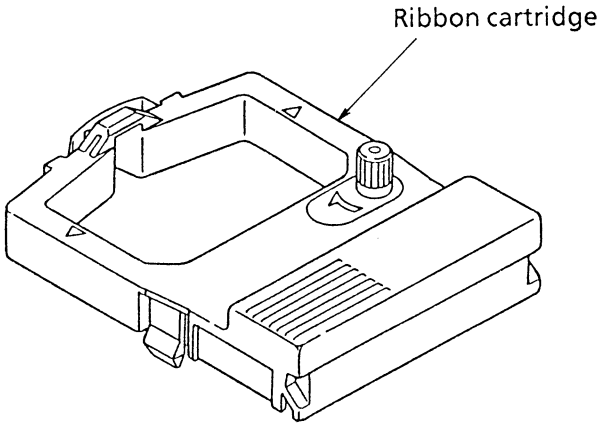
Remove the shipping retainer that secures the printhead.



2.2.3 Installing the accessories

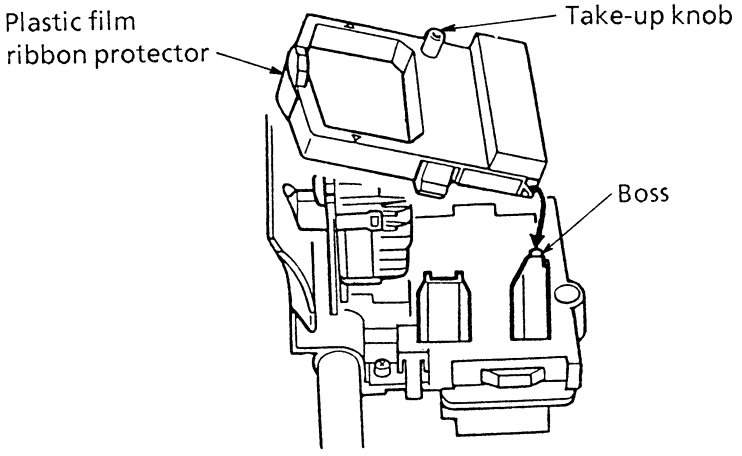
(1) Ribbon cartridge

① Remove the wrapper of the ribbon cartridge.



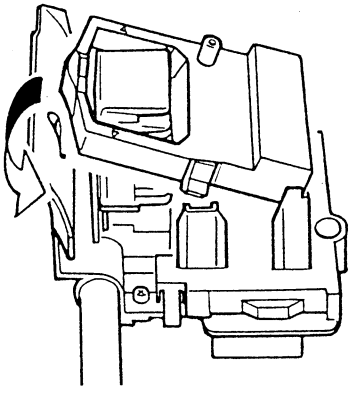
② Before setting, turn the take-up knob to tighten the ribbon.

③ Push the rear of the cartridge down first. Make sure it snaps into the boss.

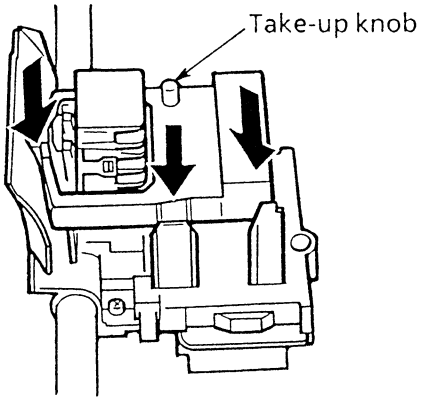


Important: Do not peel off the plastic film on the top of the cartridge. It is a part of the cartridge.

④ Lower the front of the cartridge over the printhead.



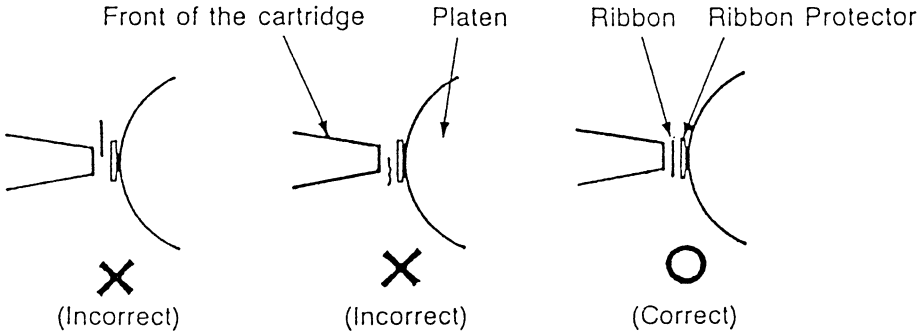
⑤ Make sure that the ribbon cartridge is fitted correctly.



⑥ Grasp the cartridge on both sides and move the print head assembly from left to right, and from to left, making sure the take-up knob revolves in the direction of its arrow icon.

Note: When passing the ribbon between the printhead and the platen, make sure that the ribbon is not twisted or bent and that the left/right arms of the cartridge fit correctly.

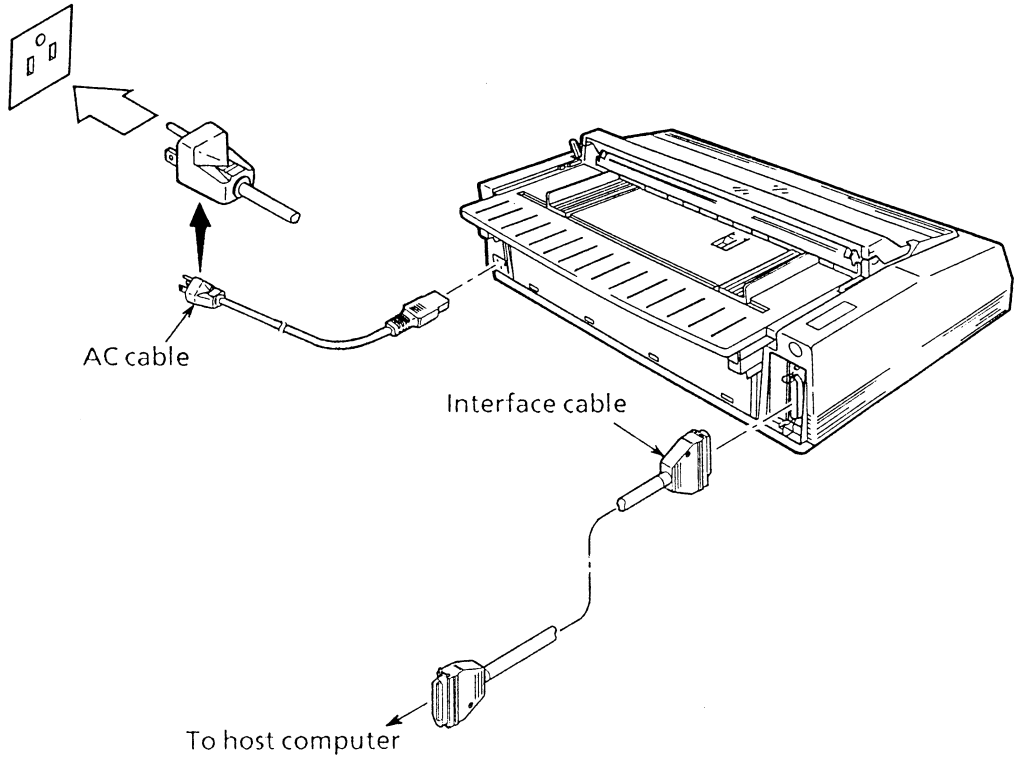
Inserting the Ribbon Cartridge [a side view]



2.2.4 Connecting cables

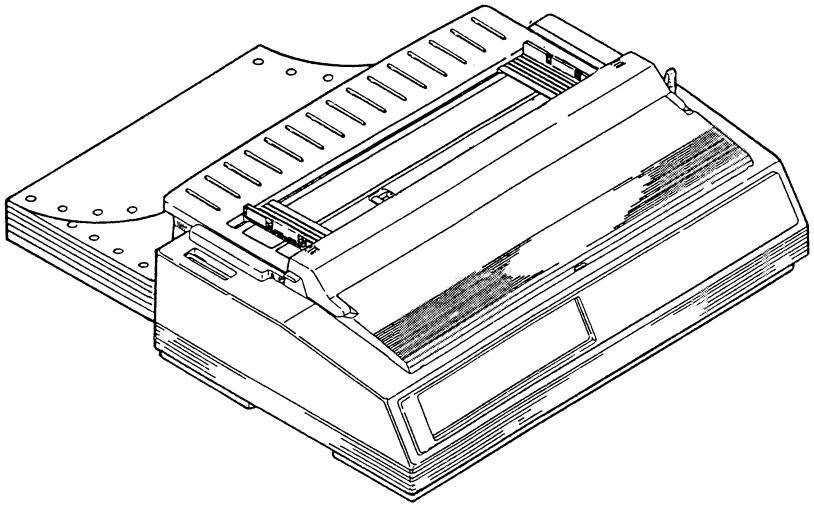
(1) Connect the AC cable to the printer.

(2) Connect the interface cable to the printer.



2.2.5 Installing paper

Install printing paper on the tractor of the printer for the selftest

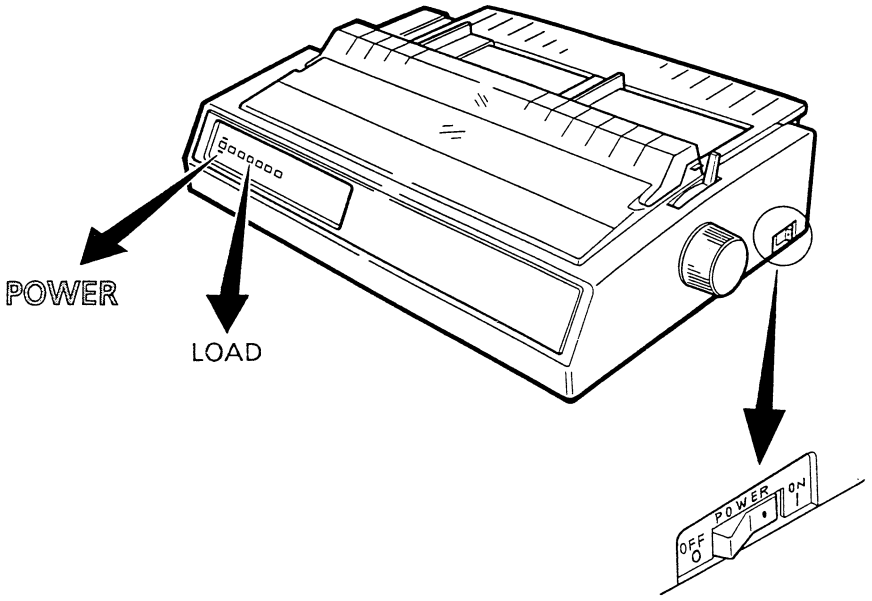


2.2.6 Powering on

(1) Turn on the POWER switch on the right side of the printer unit.

(2) Confirm that the POWER LED is on and that the printhead returns to its home (left most) position.
In case of paper end, self-adjust will be perfomed subsequently.

(3) If the printer unit shows no abnormality after it is powered on, load the printing medium by pressing LOAD switch and proceed to the next step (4) for test printing.



(4) Test printing

a) After confirming that the POWER switch is off, turn it on while pressing the QUIET/TOF switch.

b) Confirm that the printer unit prints out the test pattern as shown in the figure below.

c) Press the SELECT switch to end the printing test.

d) Confirm that the SELECT lamp is on, indicating that the printer unit is ready to receive printing data from the host computer.

e) An additional selftest can be printed that shows all the different available fonts, perform this test by holding the line feed switch while turning on the printer.

- Print pattern (reduction percentage 70%)

LQ Courier 10CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

LQ Roman 10CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

LQ Swiss 10CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

LQ Orator 10CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`ABCDEFGHIJKLMNO
PQRSTUVWXYZ{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
ABCDEFGHIJKLMNOPQRSTUVWXYZ{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`ABCDEFGHIJKLMNOPQRSTUVWXYZ{|}~
```

LQ Gothic 10CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

LQ Prestige 10CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

Utility 10CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmno
pqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'
abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~
```

LQ Swiss 18Point

```
 !"#$%&'()*+,-./Ø123456789:;<=>?@ABCDEFG
HIJKLMNOPQRSTUVWXYZ[\]^_‘abcdefghijklmno
pqrstuvwxyz{|}~ !"#$%&'()*+,-./Ø123456789
9:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_‘
abcdefghijklmnopqrstuvwxyz{|}~
```

LQ Super/Sub 12CPI

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

2.3 MENU SELECTION

2.3.1 OVERVIEW:

The purpose of the menu is to access "global" type printer features/functions as directly as possible. Features selected in MENU mode become the default features for the printer each time it is powered on. The Menu function allows the ability to activate features without the use of software commands. Software commands will override MENU settings.

2.3.2 KEY FUNCTIONS:

Key Name	Function
GROUP	General categorization of functions/features. Selects next GROUP title, once through the entire list, loops back to the first GROUP.
ITEM	Direct name of functions/features. Selects next ITEM title, once through the entire list, loops back to the first ITEM in the current GROUP.
SET	Value (setting) of the ITEM. Selects next SETTING value, once through the entire list, loops back to the beginning of the list.
PRINT	Prints entire MENU and returns to top of MENU list.
EXIT	Saves any changed settings and leaves the MENU.

Note: Pressing the SHIFT button together with GROUP, ITEM, or SET will select the next feature in reverse order (backward).

2.3.3 OPERATION

(1) To enter Menu mode, depress SEL and SHIFT switch or depress SEL switch during power up.

a. MENU mode LED = on
b. printer = deselected state
c. SEL LED = off

(2) Upon entering Menu mode, press the GROUP key, ITEM key, or SET key to print the first line of MENU. Press the PRINT key to print the whole MENU or PRINT + SHIFT to print the group items only.

(3) See Key functions above for description of operation within Menu mode.

(4) To exit MENU mode, press the SEL + SHIFT switch.

(5) If conflicting features/functions are set in menu mode, the printer will treat these function/features according to the priority table.

(6) The TOF position is not affected by MENU mode.
(However, set TOF if page length in changed)

(7) Depressing SEL/LF or FF/TEAR switches simultaneously during power-up will reset the menu back to its factory settings.
(see FACTORY SETTINGS for further details)

(8) If the Operator Panel is set to "Limited Operation", press the SEL switch during power-up in order to enter MENU.

(9) When using a CSF or SASF, upon exiting Menu the page will eject.

(10) The MENU is printed bi-directionally in the Utility mode.

2.3.4 TABLE OF MENU SELECTIONS

Group	Item	Sets
Printer Control	Emulation Mode	Epson LQ * IBM PPR IBM AGM

Group	Item	Sets
Font	Print Mode	LQ Courier * LQ Roman LQ Swiss LQ Swiss Bold LQ Orator LQ Gothic LQ Prestige Utility Font card
	Pitch	10 CPI * 12 CPI 15 CPI 17.1 CPI 20 CPI
	Proportional Spacing	No * Yes
	Style	Normal * Italics
	Size	Single * Double

Note (1): The asterisk (*) indicates default selection.

Note (2): Displayed only for the Wide machine.

Note (3): Displayed only when a roll paper is loaded.

Note (4): Displayed only in the IBM (PPR) emulation mode.

Note (5): Displayed only in the IBM (PPR) or IBM (AGM) emulation mode.

Note (6): Displayed only when double bin CSF is attached.

Note (7): Displayed only in the EPSON emulation mode.

Note (8): Common to bin 1 and 2.

Note (9): 96K works only in installing option RAM card.

Group	Item	Sets
Symbol Sets	Character Set	Set I Set II *
	Language Set	ASCII * French German British Danish I Swedish I Italian Spanish I Japanese Norwegian Danish II Spanish II Latin American French Canadian Dutch Swedish II Swedish III Swedish IV Turkish Swiss I Swiss II Publisher
	Zero Character	Slashed Unslashed *
	Code Page	USA * Canada French Multilingual Portugal Norway Turkey
	Slashed Letter O	No * Yes

Group	Item	Sets
Rear Feed	Line Spacing	6 LPI * 8 LPI
	Form Tear-Off	Off * 500ms 1 sec 2 sec
	Skip Over Perforation	No * Yes
	Page Width Note(2)	13.6" * 8"
	Page Length	11" 11 2/3" 12" * 14" 17" 3" 3.5" 4" 5.5" 6" 7" 8" 8.5"
	Gap Control	Auto Gap * Semi Auto Gap 1 2 3 4 5 6 7 8 9

Group	Item	Sets
Bottom Feed	Line Spacing	6 LPI * 8 LPI
	Form Tear-Off	Off * 500ms 1 sec 2 sec
	Skip Over Perforation	No * Yes
	Page Width Note(2)	13.6" * 8"
	Page Length	11" 11 2/3" 12" * 14" 17" 3" 3.5" 4" 5.5" 6" 7" 8" 8.5"
	Gap Control	Auto Gap * Semi Auto Gap 1 2 3 4 5 6 7 8 9

Group	Item	Sets
Top Feed	Line Spacing	6 LPI * 8 LPI
	Form Tear-Off Note(3)	Off * 500ms 1 sec 2 sec
	Bottom Margin	Valid * Invalid
	Page Width Note(2)	13.6" * 8"
	Page Length	11" 11 2/3" * 12" 14" 16.57" 3" 3.5" 4" 5.5" 6" 7" 8" 8.5"
	Gap Control	Auto Gap * Semi Auto Gap 1 2 3 4 5 6 7 8 9
	Wait Time	500ms 1 sec * 2 sec

Group	Item	Sets
Set-Up	Graphics	Bi-directional Uni-directional *
	Receive Buffer Size Note(9)	1 Line 32K 64K * 96K
	Paper Out Override	No * Yes
	Print Registration	0.25 mm Right 0.20 mm Right 0.15 mm Right 0.10 mm Right 0.05 mm Right 0 * 0.05 mm Left 0.10 mm Left 0.15 mm Left 0.20 mm Left 0.25 mm Left
	Operator Panel Function	Full Operation * Limited Operation
	Reset Inhibit	No * Yes
	Print Suppress Effective	No Yes *
	Auto LF	No * Yes
	Auto CR Note(4)	No * Yes
	CSF Bin Select Note(6)	Bin 1 * Bin 2
	SI Select Pitch-(10CPI) Note(5)	15 CPI 17.1 CPI *
	SI Select Pitch (12CPI) Note(5)	12 CPI 20 CPI *
	Time Out Print	Valid * Invalid
	Auto Select	No * Yes
	Smoothing	Valid * Invalid
	Ribbon Selection	Black Ribbon * Black Yellow Magenta Cyan Violet Orange Green
	Printhead Gap Adjust	+ 1 0 * – 1
	Graphics Speed	High Low *

Group	Item	Sets
Parallel I/F	I-Prime	Invalid Buffer Print * Buffer Clear
	Pin 18	+ 5V * Open
	Auto Feed XT Note(7)	Valid Invalid *

Group	Item	Sets
Serial I/F (Effective only when serial I/F board is mounted)	Parity	None * Odd Even
	Serial data 7/8 Bits	8 Bits * 7 Bits
	Protocol	Ready/Busy * X-ON/X-OFF
	Diagnostic Test	No * Yes
	Busy Line	SSD- * SSD + DTR RTS
	Baud Rate	9600 BPS * 4800 BPS 2400 BPS 1200 BPS 600 BPS 300 BPS 19200 BPS
	DSR Signal	Valid * Invalid
	DTR Signal	Ready on Power Up * Ready on Select
	Busy Time	200 ms * 1 sec

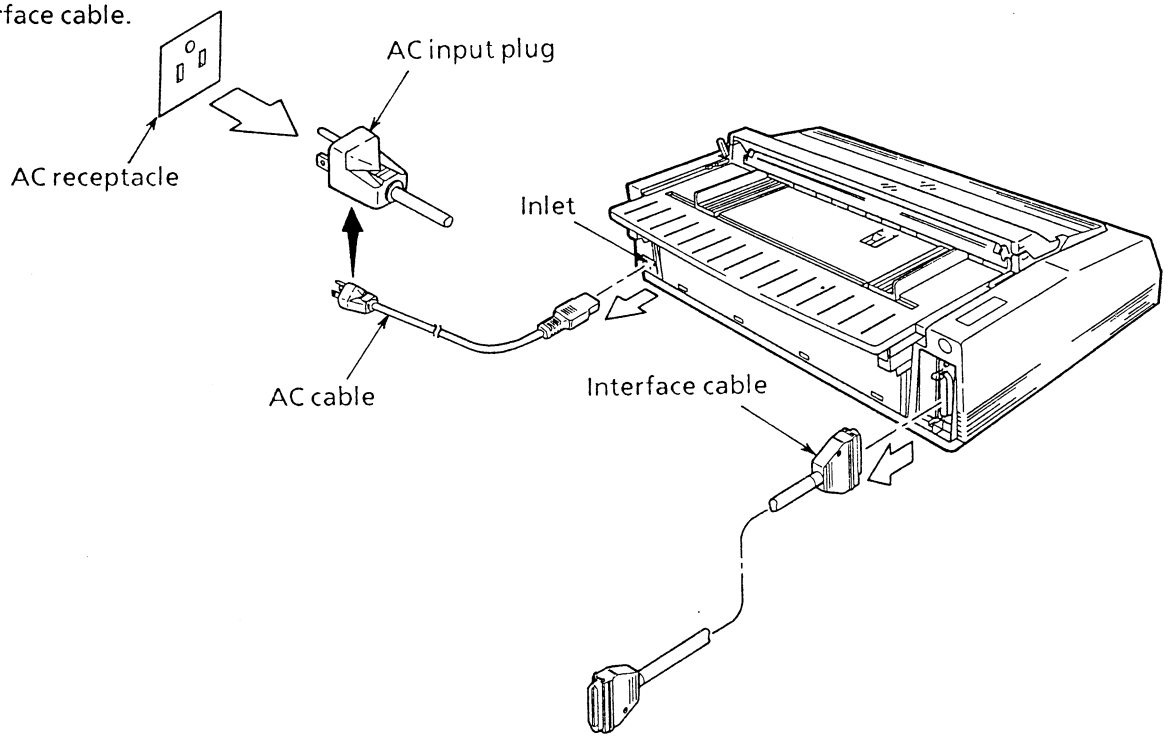
Group	Item	Sets
CSF Bin 1 (Effective only when CSF is attached)	Line Spacing	6 LPI* 8 LPI
	Bottom Margin	Valid * Invalid
	Page Width Note(2), Note(8)	13.6" * 8"
	Page Length	11" 11 2/3" * 12" 14" 16.57" 3.5" 4" 5.5" 6" 7" 8" 8.5"
	Gap Control	Auto Gap * Semi Auto Gap 1 ⟆ 9

Group	Item	Sets
CSF Bin 2 (Effective only when double bin CSF is attached)	Line Spacing	6 LPI * 8 LPI
	Bottom Margin	Valid * Invalid
	Page Length	11" 11 2/3" * 12" 14" 16.57" 3.5" 4" 5.5" 6" 7" 8" 8.5"
	Gap Control	Auto Gap * Semi Auto Gap 1 ⟆ 9

2.4 Installing the Option Kits

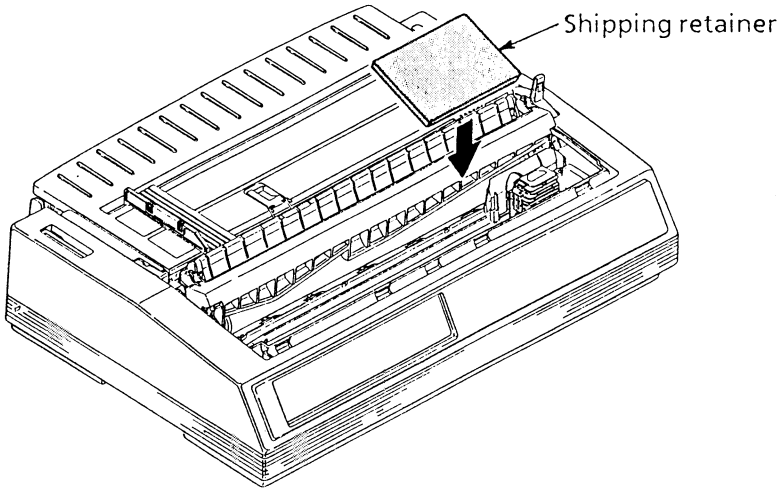
To install the bottom push tractor unit, pull tractor assy, colour shift unit, and roll paper stand (ML590 only) use the following procedure:

Before installing any option kit, turn OFF the power switch of printer and disconnect AC cable and interface cable.



2.4.1 Bottom push tractor unit

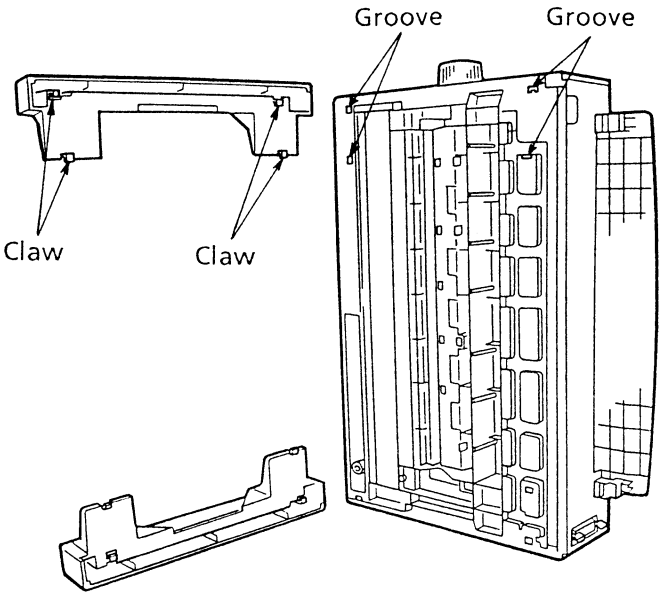
(1) Set the shipping retainer to secure the printhead. If not available, tilt slowly to prevent printhead from banging against side of unit.



(2) Place the printer on a flat surface with the operation panel facing your side, and stand the printer with the right side up.

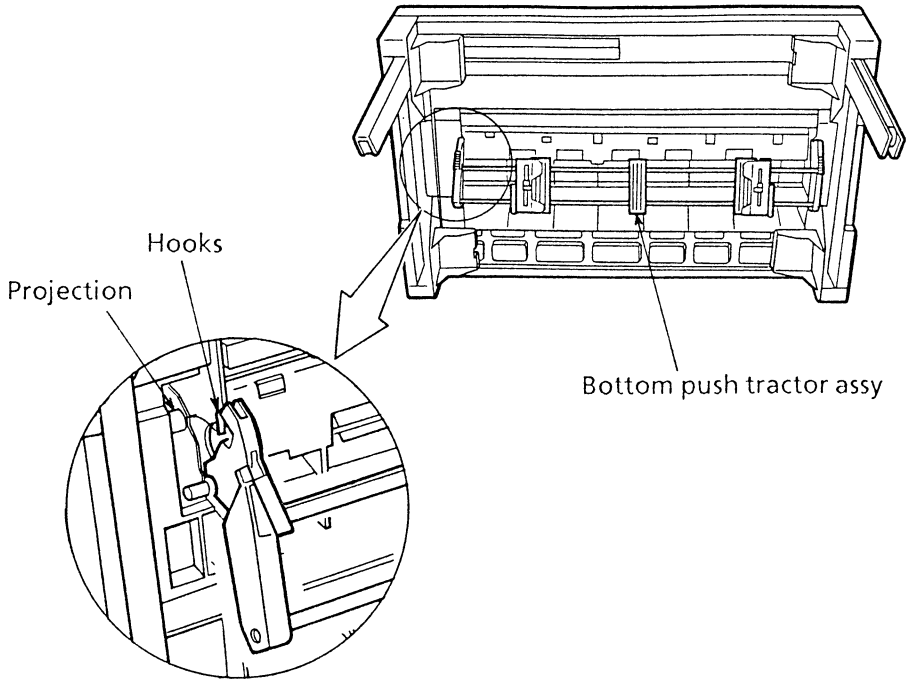
(3) To install the stand assy hook the four claws to the four notches in the main chassis respectively.

(4) First remove platen Knob, then erect the printer with the left side up, install the stand Assy in the same manner as (3).



(5) Stretch the legs of both stand assemblies to raise the front side of printer.

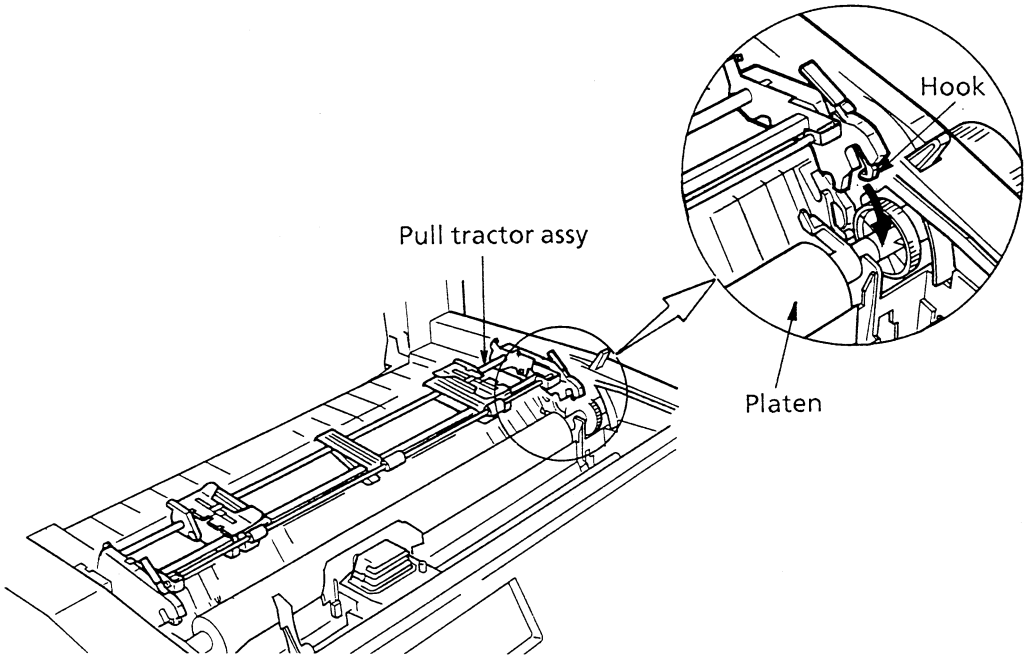
(6) Install the bottom tractor Assy by hooking to the protrusion of main chassis.



2.4.2 Pull tractor assy

(1) Remove the pull-up roller Assy.

(2) Hooking claws of pull tractor Assy to the platen Assy, install the pull tractor Assy.

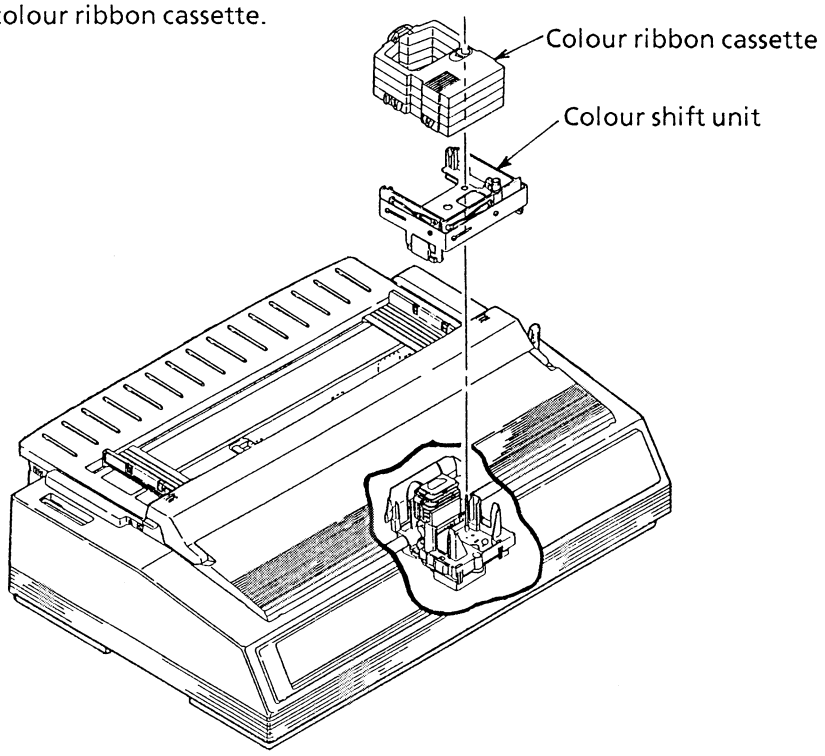


2.4.3 Colour Kit

(1) Open the connector cover of gear case Assy.

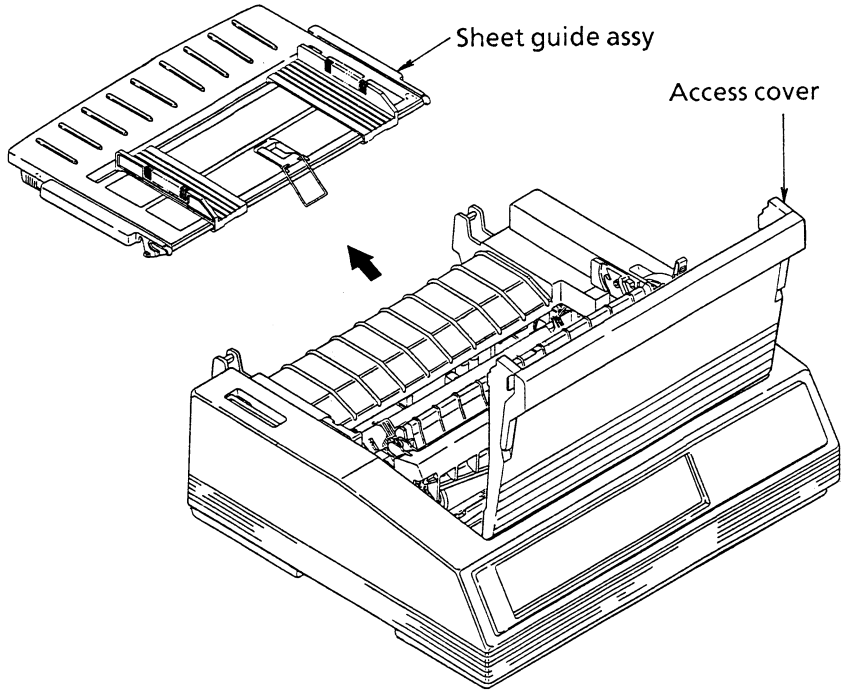
(2) Hooking claws of colour shift unit to the ribbon drive gear Assy, install the colour shift unit.

(3) Mount a colour ribbon cassette.

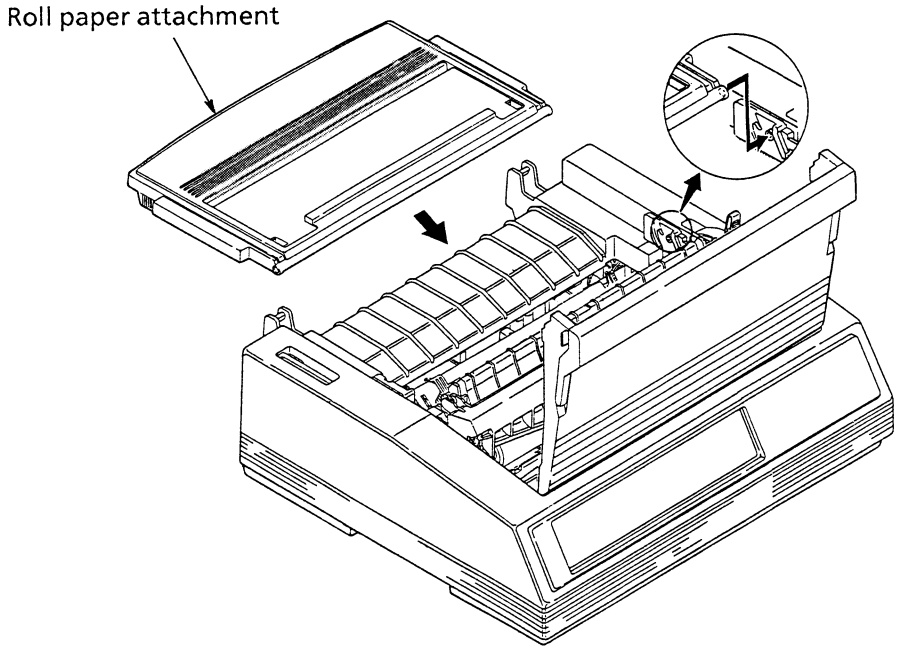


2.4.4 Roll Paper Stand (ML590 only)

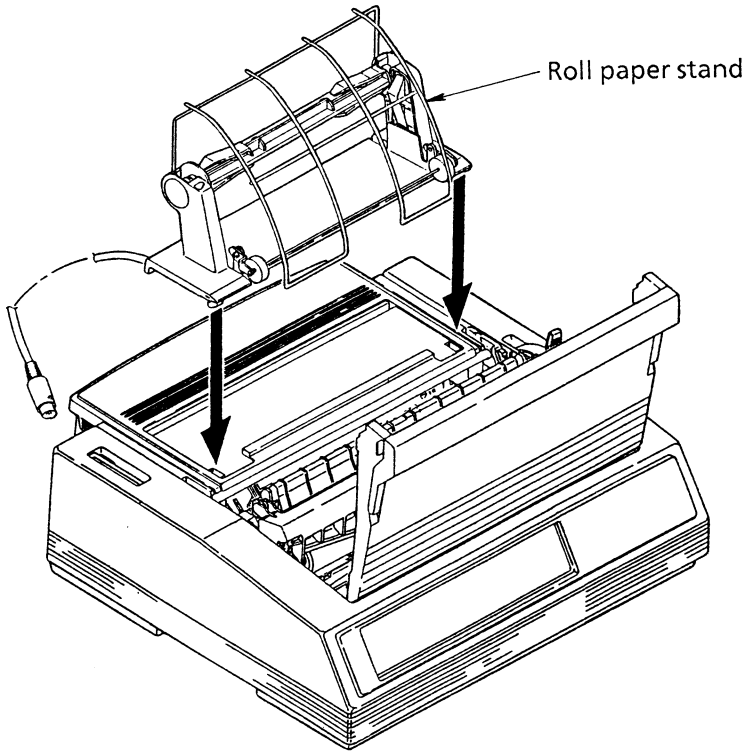
(1) Open the access cover and remove the sheet guide assembly.



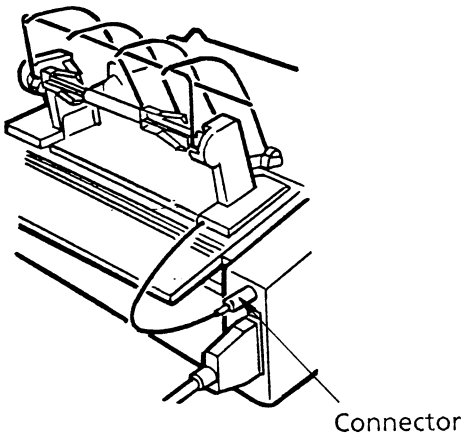
(2) Install the roll paper attachment.



(3) Install the roll paper stand by hooking the catches of the roll paper stand to the two grooves of the roll paper attachment.



(4) Insert the connector with main PCB.



3. THEORY OF OPERATION

3. THEORY OF OPERATION

3.1 Electrical Operation

The electrical operation of the printer circuit is described in this section.

3.1.1 Summary

Fig. 3-1 shows the block diagram of the printer.

The control board is made up of the microprocessors, peripheral circuits, drive circuits, sensors and interface connectors.

The power to the control board is supplied by the power board through the connector cord.

The power to other electrical parts is also distributed through the connectors within the control board.

3.1.2 Microprocessor and the peripheral circuit

(1) Microprocessor (04D:67X640)

This processor is a CMOS single-chip computer with integrated peripheral device functions and a 16 bit MPU core, all OKI original architecture.

The processor has a 20 bit address bus and a 16 bit data bus.
It is capable of accessing up to 1M word program memory and 1M bytes of data memory.

The following characteristics are also provided:

- Built-in type data memory of 512k bytes
- 8-bit 4-channel A/D converter x 1
- 16-bit automatic reload timer x 2
- 8-bit serial port x 2
- 8-bit parallel port x 3 (bitwise I/O specification available)

And others.

The function of this microprocessor is to provide a central mechanism for the entire printer by executing the control program through the LSI and driver circuits.

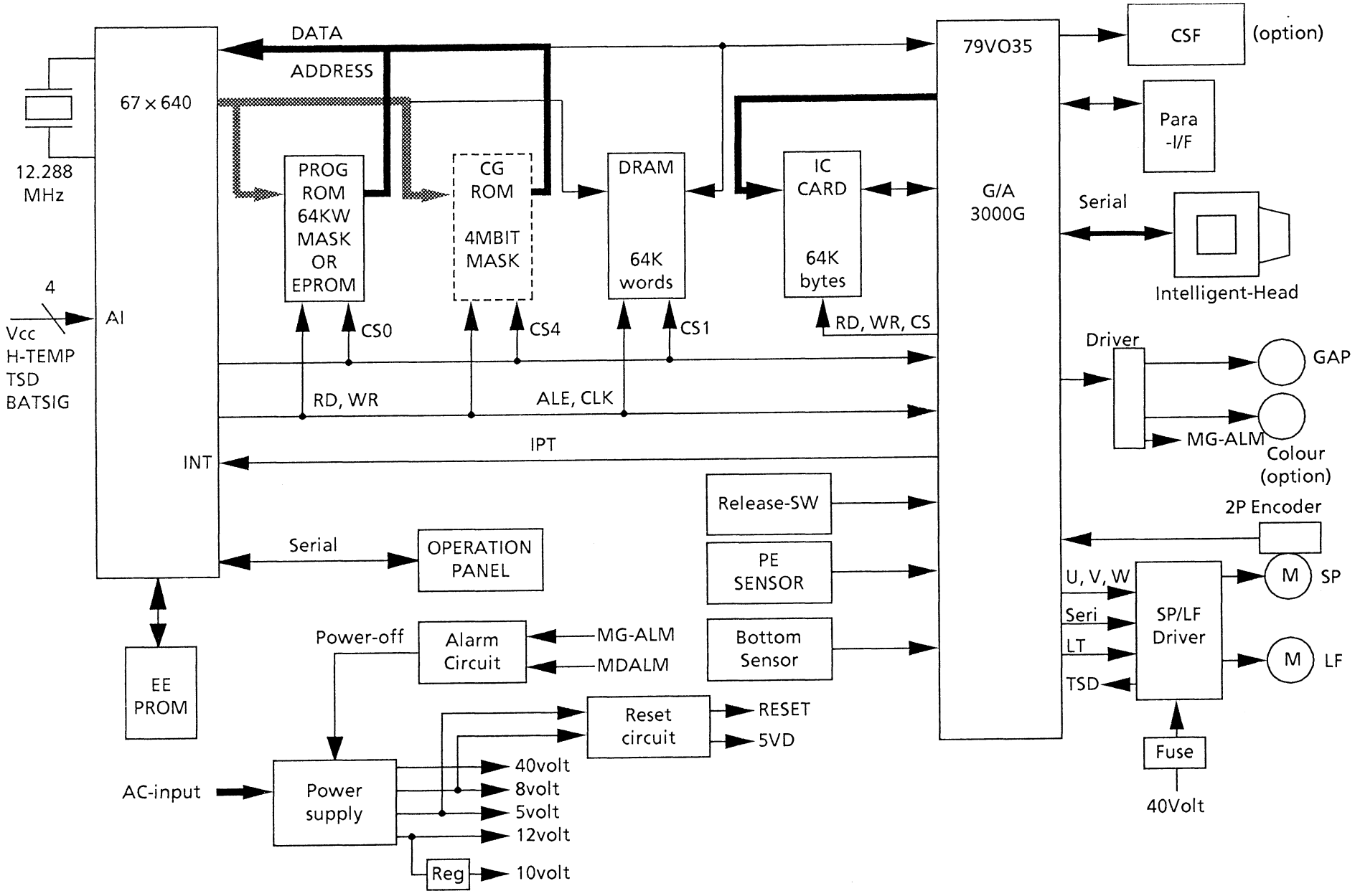


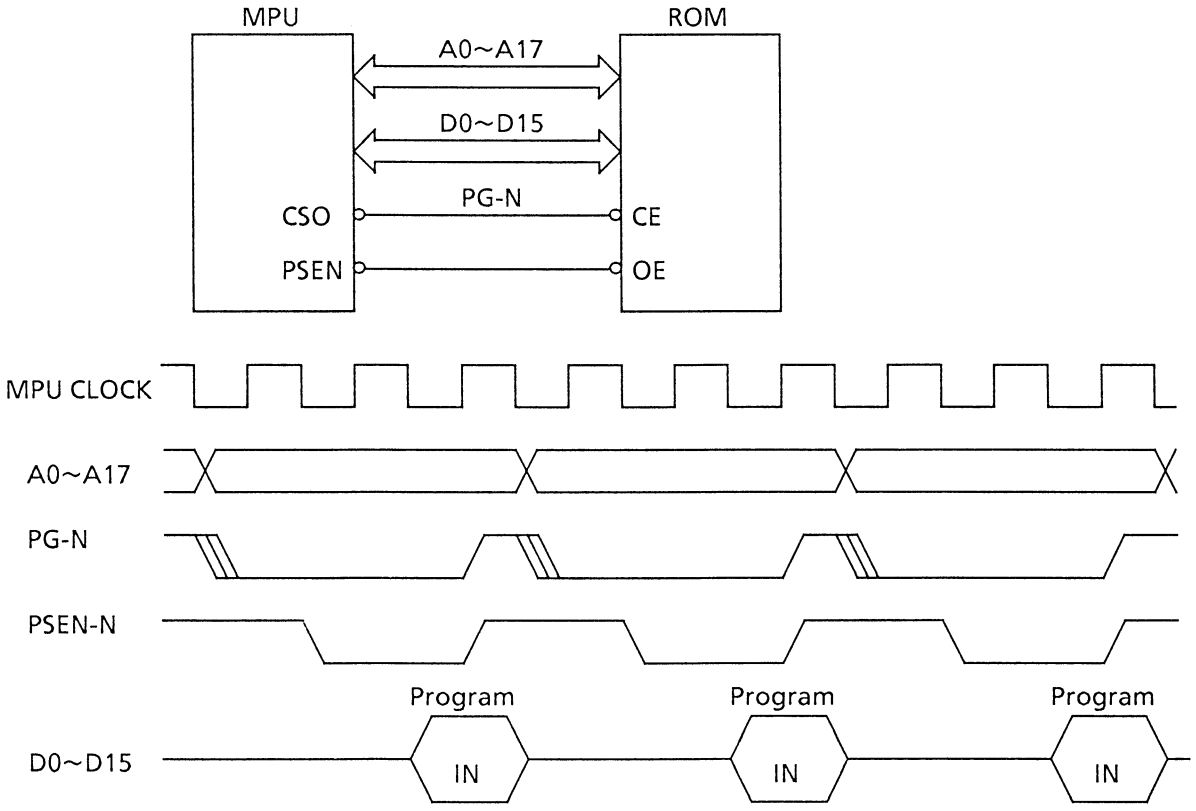
Figure 3-1 ML590/591 BLOCK DIAGRAM

(2) Program ROM (05D:27C1024)

This is a 64k x 16 bits (1M bits) EPROM with the control program for the printer stored. The MPU executes instructions under this program.

The program ROM is assigned to the program memory area of the MPU and is fetched by the PSEN signal of the MPU.

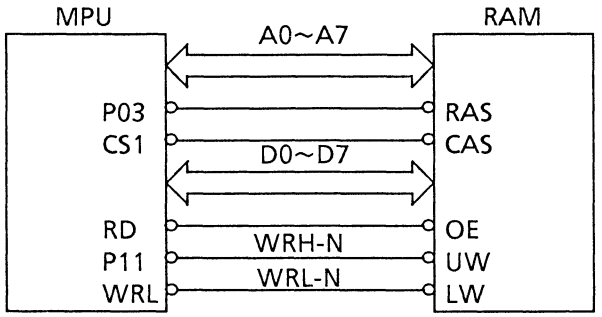
The following shows the operation of the memory access.

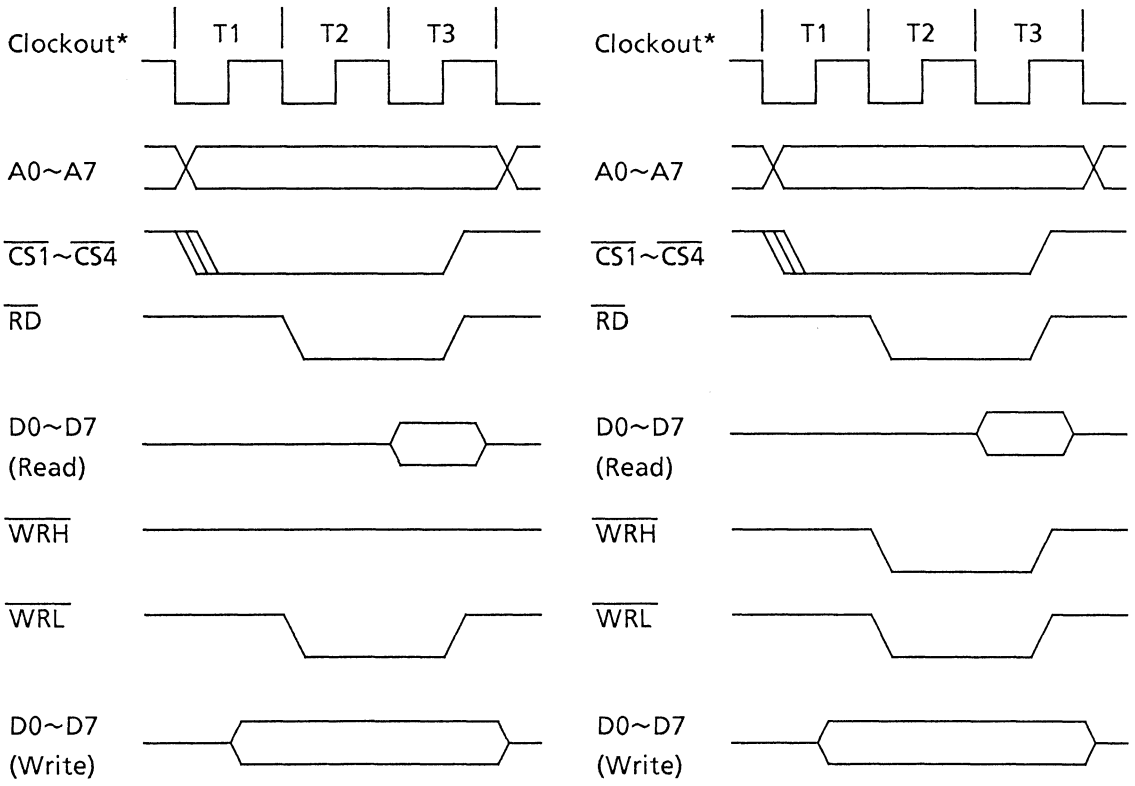


(3) RAM (05E:511664Z)

The RAM is CMOS dynamic RAM with 64K x 16-bit configuration, and used as buffers (such as receiving buffer, printing buffer, DLL buffer and working buffer).

The following shows the examples of the memory access operation.





8-bit bus, byte instruction

16-bit bus, word instruction

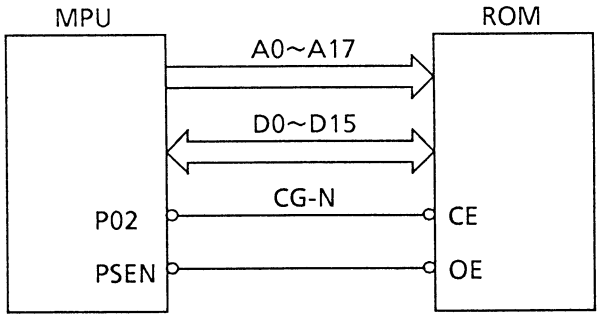
*Clockout is provided when the original excitation is selected.

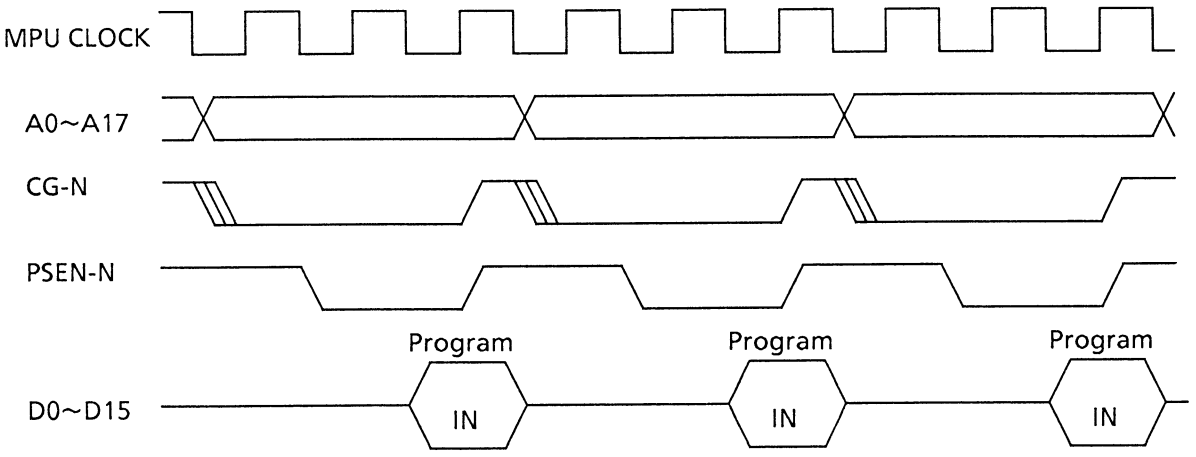
(4) CG ROM (05C:62444)

This is a 256k x 16 bits (4M bits) MASK ROM with the font data for the characters stored.

CG ROM is assigned to the program memory area of the MPU and is fetched by the PSEN signal of the MPU.

The following shows the memory access operation.



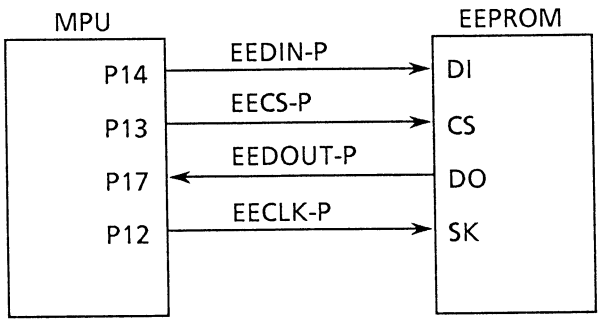


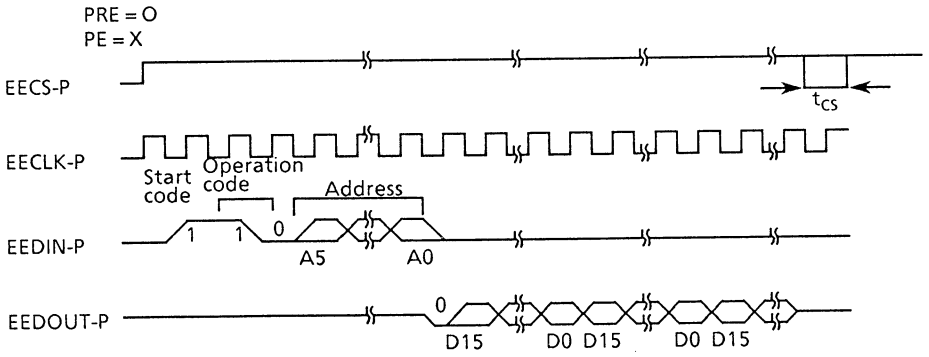
(5) EEPROM (03C:93CS46)

The EEPROM is a CMOS serial I/O type memory which is capable of electrically erasing and writing 1,024 bits.

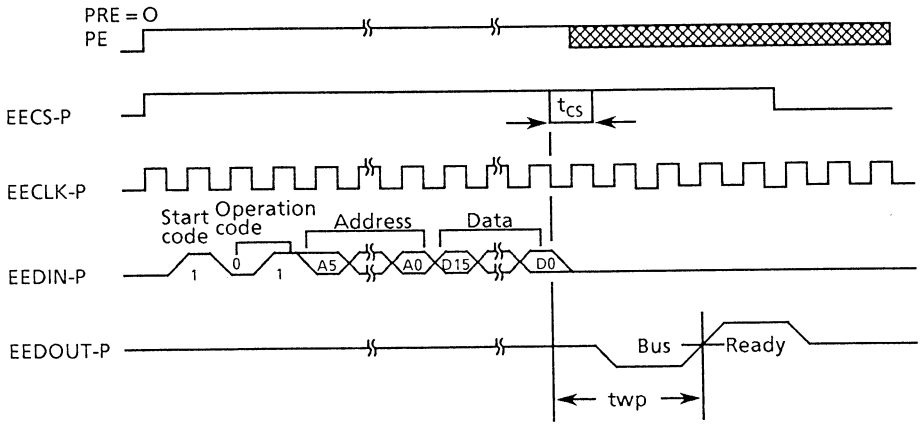
The EEPROM contains menu data and the head drive time correction data.

The following shows the memory access operation.





Read cycle timing (READ)

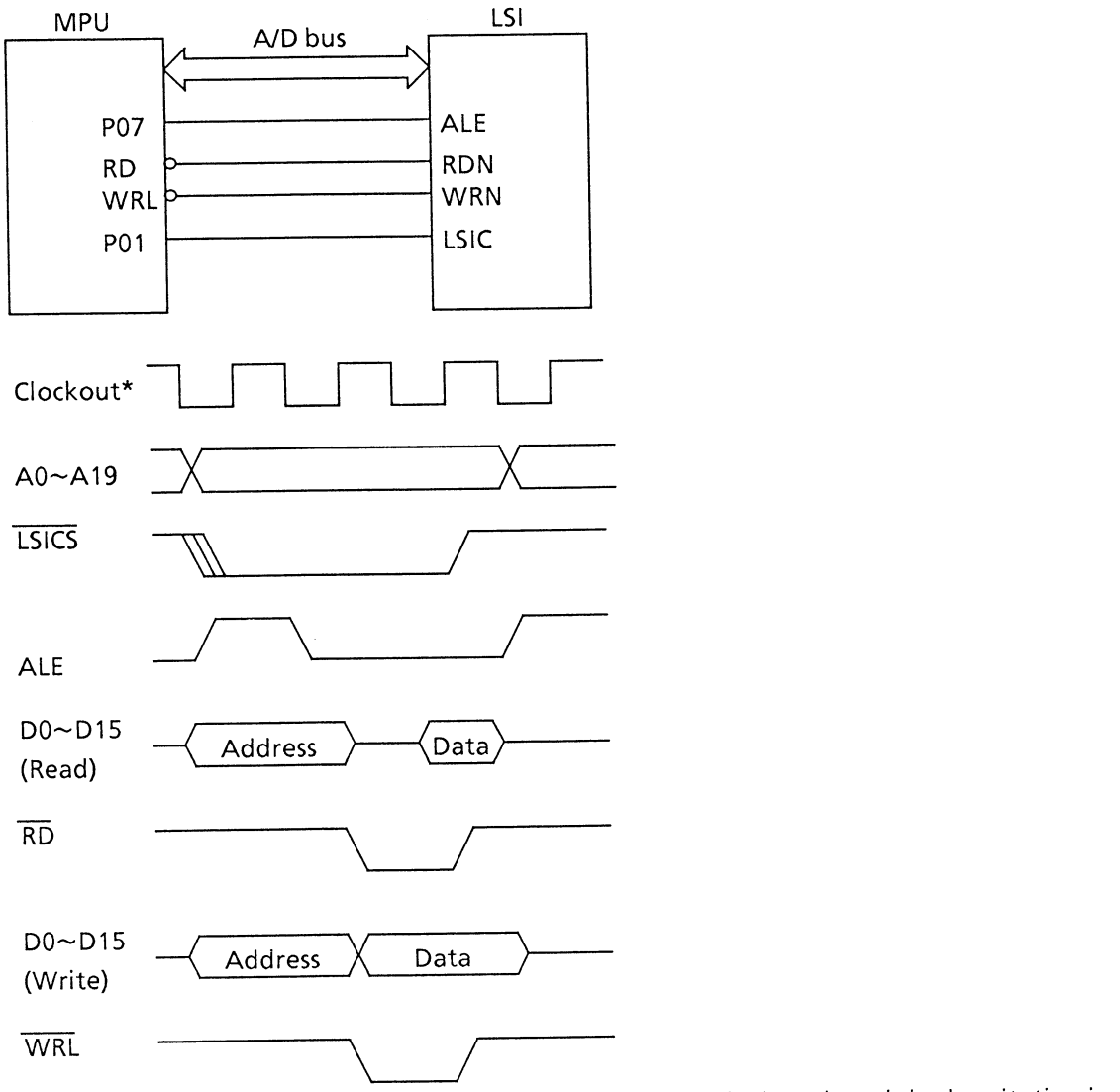


Write cycle timing (WRITE)

(6) LSI (02D:MSM79V035)

This LSI detects and controls the LF/SP motor speeds by monitoring the two phase sensor signals obtained from the DC motors and modifying the excitation phases as appropriate. Other functions are to transmit and receive serial data to and from the Printhead LSI to control the dot timing, and to control the external interface.

This LSI is connected in multiplex to the MPU.



* Clockout is provided when the original excitation is selected.

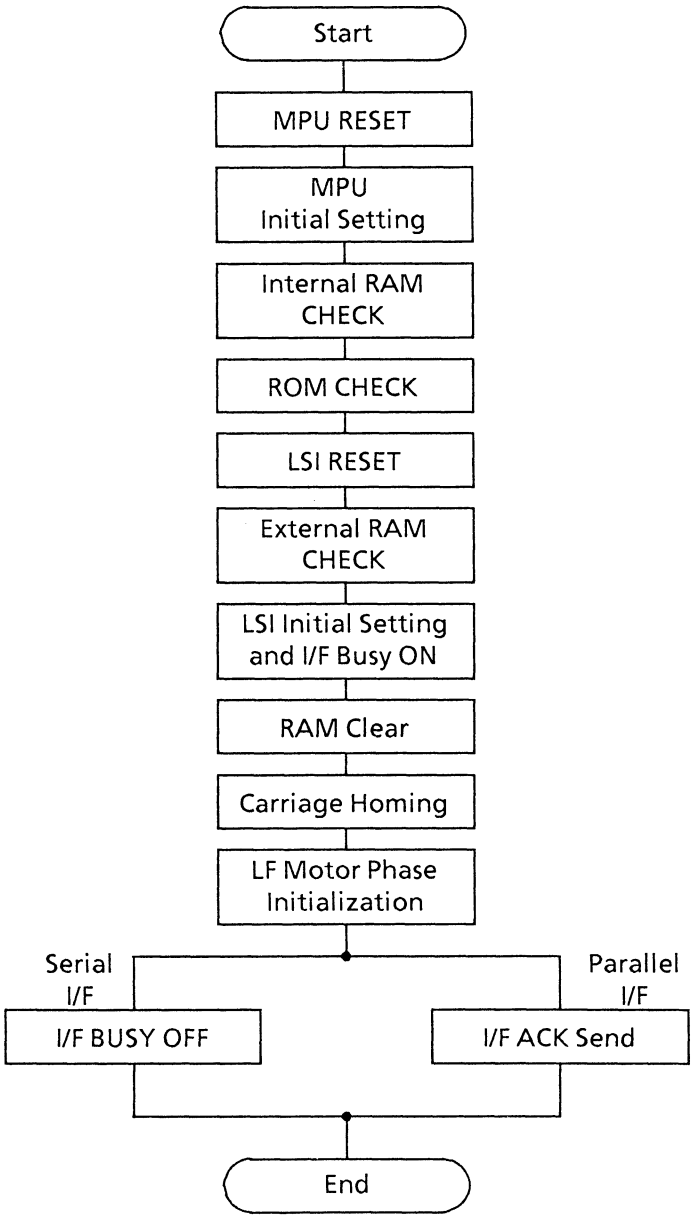
3.1.3 Initialization

This printer is initialized when the power is turned on or when the I-PRIME-N signal is input from the host side via the parallel interface.

For the initialize operation, the RST-N signal is first output from the reset circuit to reset the MPUs and LSIs. When resetting ends, the program starts and the LSIs are reset by MPU via IORST-N. Reset operation by I-PRIME starts program to initialize, but does not reset the MPU.

The program here sets the mode of the LSI (02D) including the MPU (04D), checks the memories (ROMs and RAMs), then carries out carriage homing, and determines the LF motor phase.

Finally, the program establishes the interface signals (P-I/F: ACK-P signal sending, and S-I/F: BUSY-N signal off) and lights the SELECT lamp to inform the ready state for receiving to the host side and ends the initialize operation.



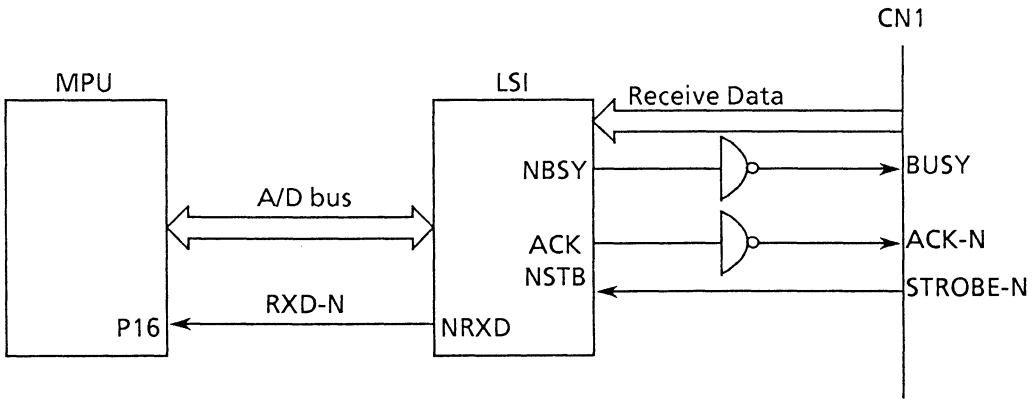
After initial operation, the self-adjust operation will start automatically at the paper end condition.
This operation is performed to always renew the self-adjust data and to maintain optimum auto gap and printing condition.

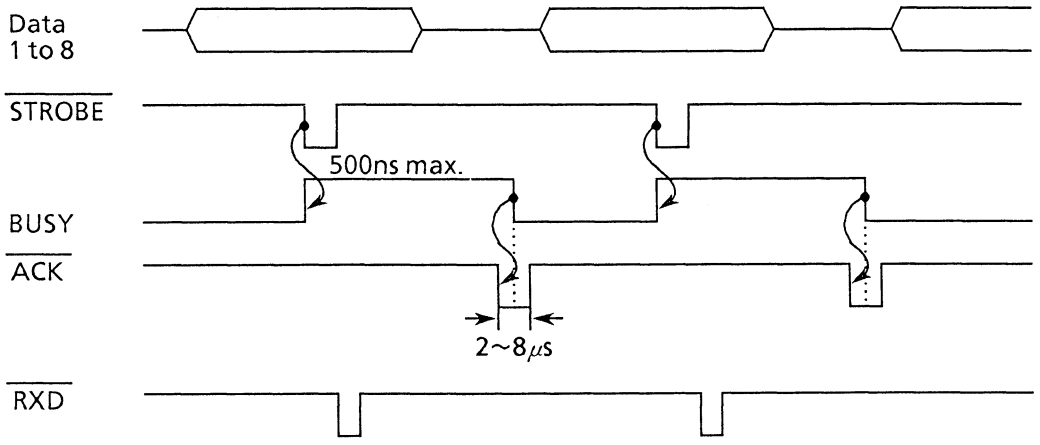
3.1.4 Parallel Interface Control

The parallel data input from the host to the interface LSI is latched to its internal register at the falling edge of the STROBE-N signal.

At the same time, the LSI sets the BUSY signal to the high level to inform the host that the data is being processed, and outputs the RXD-N signal to inform the MPU of data reception. The data is read upon receiving the RD-N signal from the MPU.

When the data processing ends, the BUSY signal is set to off and the ACK-N signal in sent to request the next data. When reception is impossible because the buffer is full, the BUSY signal is sent to request stopping of data transmission.

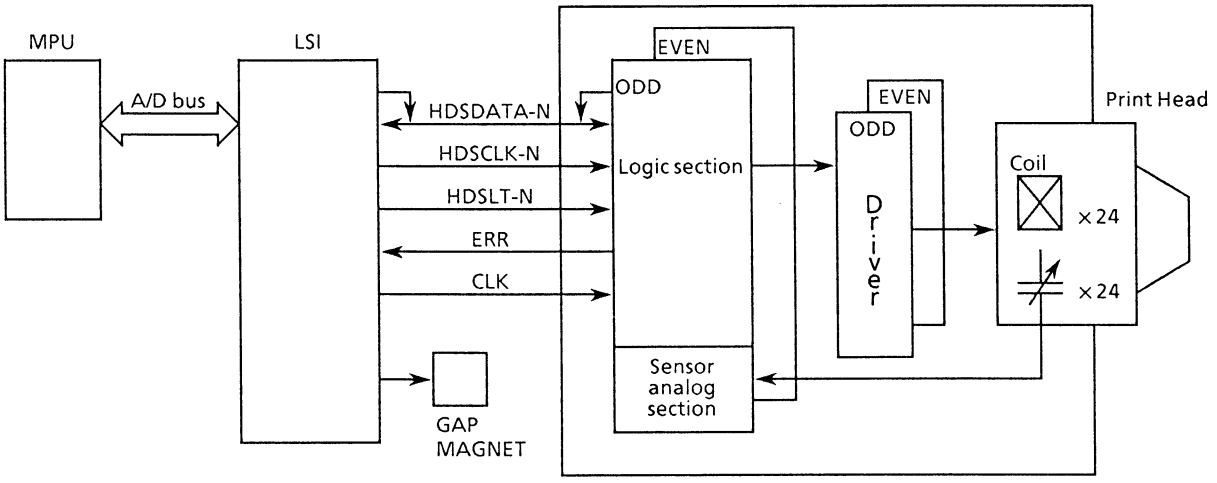




3.1.5 Print Control

Print data is transmitted as serial data to the control circuit and the driver contained in the print head through the LSI from the MPU, and is printed by each pin of the print head.

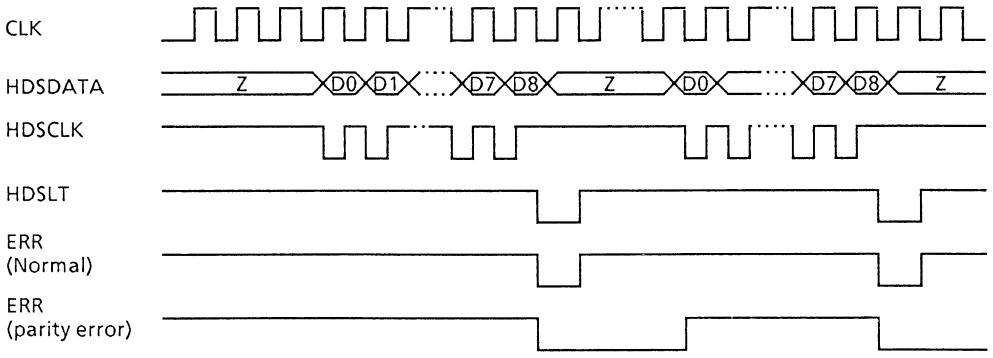
After the data is printed, the sensor analog circuit controlling each pin feeds back the pin stroke to the MPU to make an automatic head gap adjustment. This feedback signal sets the optimum drive time for each pin to maintain the print quality in the best condition.



(1) LSI/Print HEAD Interface

The connection between the LSI and the print head is made with the bidirectional serial data bus. The LSI transmits the print data as serial data to the logic circuit of the print head. The print head, while printing through the driver, feeds back to the LSI as serial data the dot pin information printed from the print head sensor analog circuit to determine the optimum drive time for the next printing.

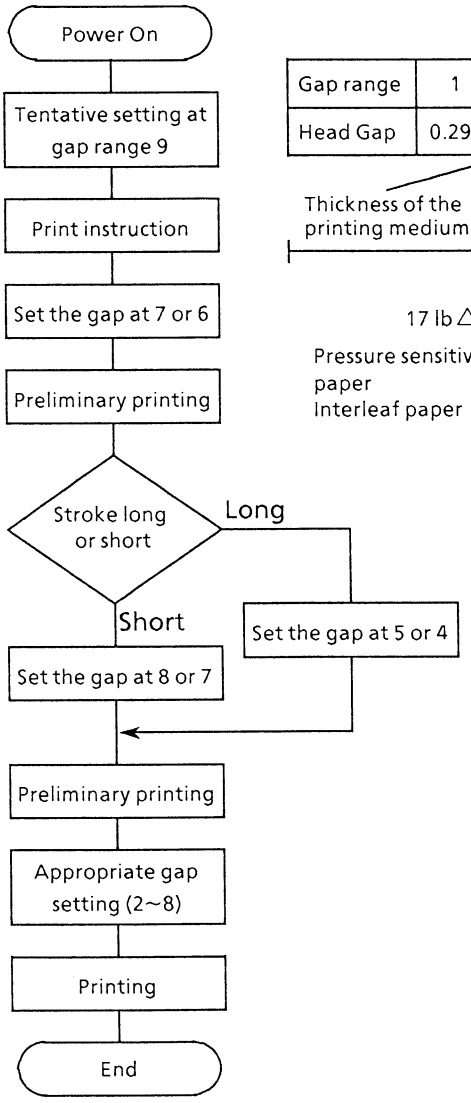
Also, the logic circuit of the print head outputs an error signal to the LSI. However this signal is output only when a parity error is found in the print data, and serves as a circuit to retransfer data transmitted previously from the LSI.

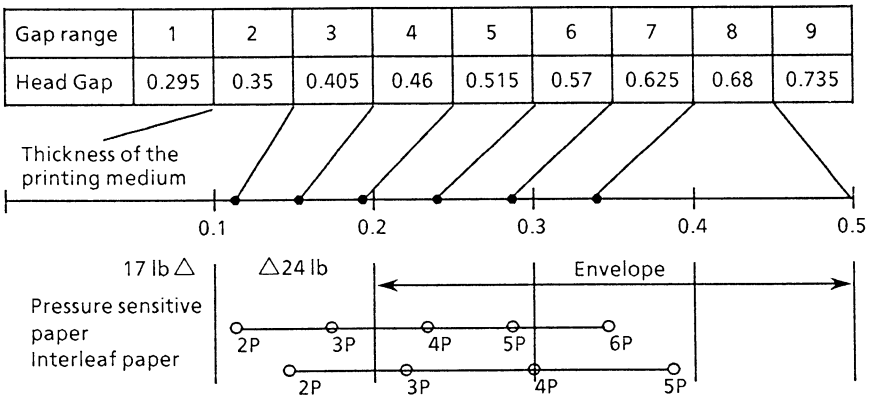


(2) Gap Adjust Control

This feeds back to the LSI the stroke length information for all the pins of the print head sensor analog circuit, and specify the optimum gap for the printing medium to set the gap automatically by the driving force of the SP motor and the trigger magnet.

a. Automatic Gap Adjust Control (Menu: When setting the auto gap.)





- In case the thickness of the printing medium is equivalent to the gap range 5 or more, set the gap range 8 for the TOP paper path. (Except when colour printing is specified). Accuracy of automatic gap with respect to the thickness of the printing medium is ± 1.
- In case of colour printing, gap setting is as follows:
  Yellow: Normal gap setting + 4
  Other colour: Normal gap setting + 2

b. Auto Gap and Fixed Gap Adjust control

Gap range	1~3	4~6	7~9
Print Speed	High (100%)	Mid (85%)	Low (50%)

As shown in the table left, three print speeds are available according to the thickness of the printing medium.

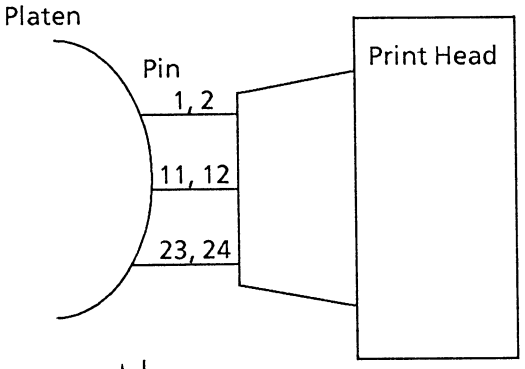
(3) **Print Compensation Control**

The print compensation can be made as shown below:

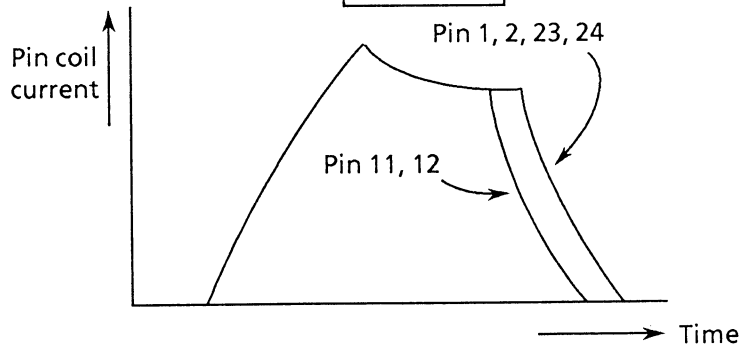
(a) Voltage compensation (See (f) and 3.1.8 "Alarm Circuit.")

(b) Temperature compensation (See 3.1.8 "Alarm Circuit.")

(c) Pin stroke compensation



As shown in the drawing left, the stroke length up to the platen is different for each pin, and this information within the print head is fed back to the logic circuit from the sensor analog circuit to set the optimum drive time for each pin by controlling the pin coil current for each pin.



(d) Simulteneous Compensation of the number of impact pins

The MPU is provided with the compensation table for each pin to make necessary compensation.

Print Pattern	Pin numbers impacted simutaneously.
When the next print column is not provided.	Simultaneous printing is available for all 24 pins.
When the next print column is provided.	2-pass printing is made for 18 pins or more

(e) Print mode compensation

According to the thickness of the printing medium, the print mode is compensated as shown in the table below:

Head Gap Range	(1)~3	4~6	7~(9)
Print speed	100%	85%	50%
Drive time	Short ←——→ Long		

(Drive time lengthens at each step.)

(f) Voltage compensation

The drive time is compensated according to the drive voltage as shown in the table below:

Volt	Low —— High	
Drive time	Long —— Short	
Print speed	2 pass	50% —— 100%

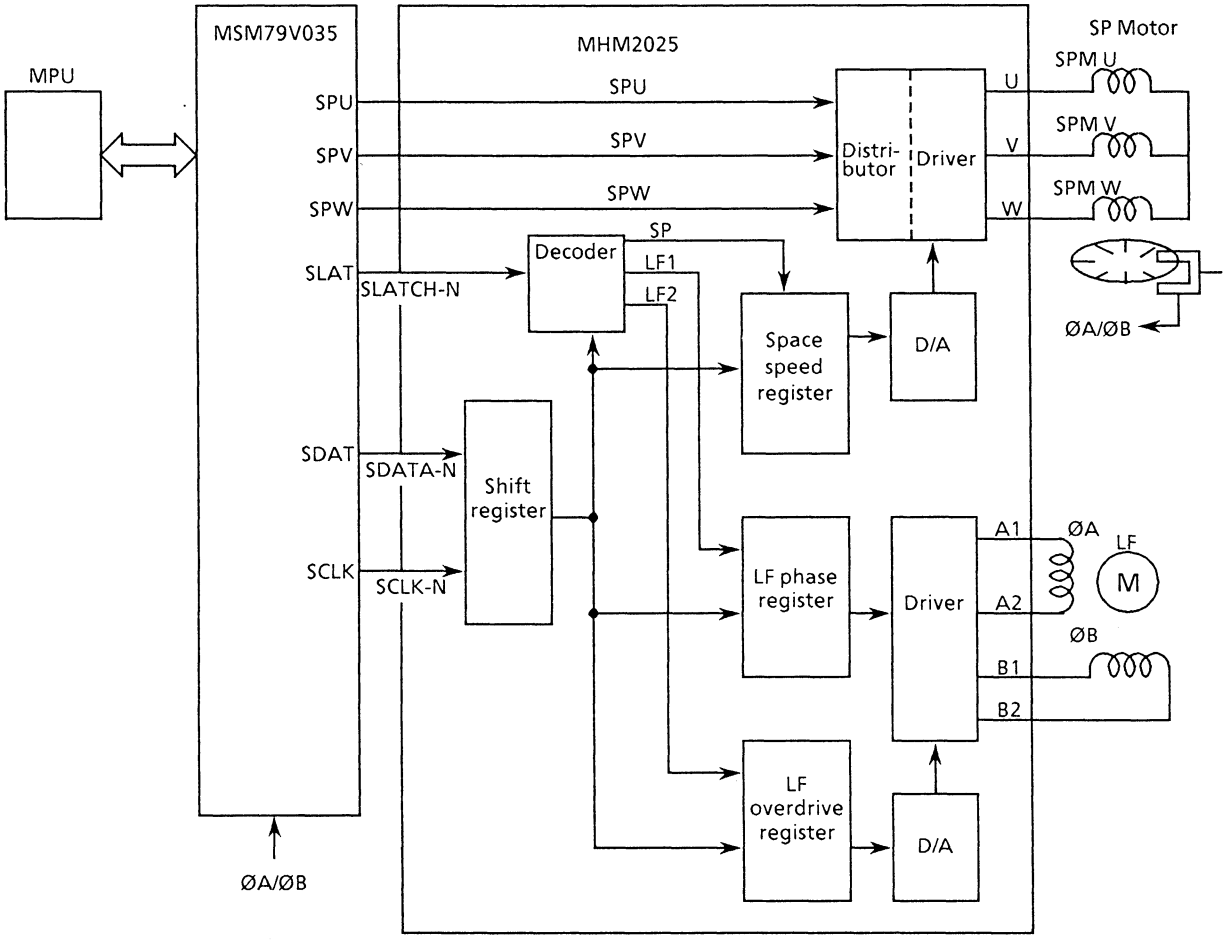
(g) Self-adjust compensation

The drive time and the cycle time are compensated according to the average print speed of the print pins when the self-adjust is performed.

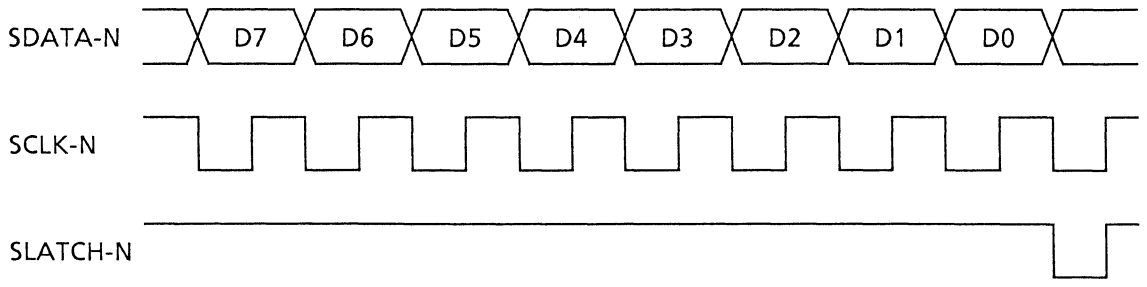
Average print speed	High	Low
Drive time	Short —— Long	
Cycle time	Normal	Down

3.1.6 SP/LF Motor Control

The LSI (02D:MSM79V035) transmits serially the SP motor data and the LF motor control data to the SP/LF motor driver, according to the commands sent from the MPU.



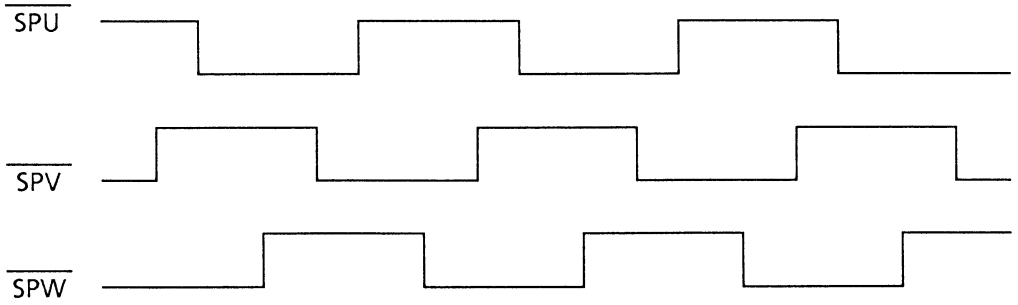
Transmission of SP/LF Motor Control Data



(1) Space Motor Control

The SP/LF motor driver (05A:MHM2025) drives the three-phase brushless space motor based on the phase signal (SPU, SPV and SPW) and the speed instruction data from the LSI. The MPU can identify the current speed of the space motor by measuring through the LSI the pulse length of the output (ϕ A, ϕ B) of the slit encoder included in the space motor.

By comparing the target speed for each print mode with the actual current speed to change the speed instruction data, the motor speed is accelerated or decelerated to maintain the specified speed for each print mode.



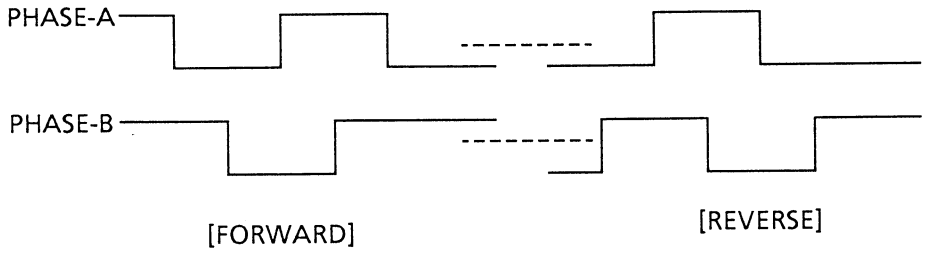
SP truth table

HALL AMP INPUT			OUTPUT		
$\overline{SPU}$	$\overline{SPV}$	$\overline{SPW}$	U	V	W
H	H	L	OPEN	L	H
H	L	L	L	OPEN	H
H	L	H	L	H	OPEN
L	L	H	OPEN	H	L
L	H	H	H	OPEN	L
L	H	L	H	L	OPEN

(2) LF Motor Control

The SP/LF motor driver (05A:MHM2025) drives the LF motor in two-phase or 1-2 phase bipolar, based on the phase changeover data and the output current data from the LSI.

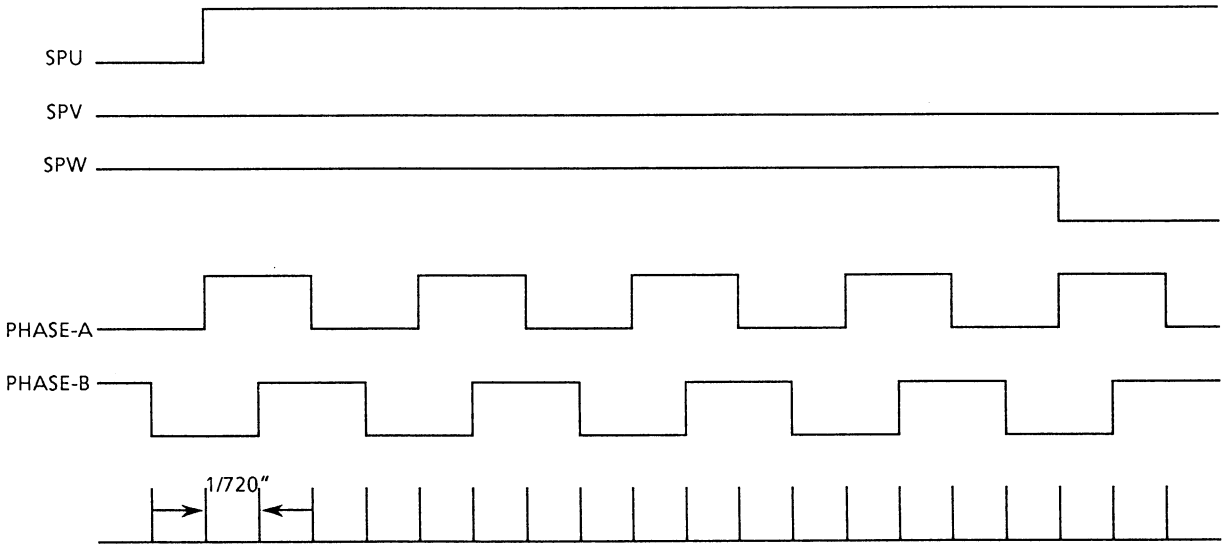
The serial data from the LSI (02D:MSM79V035) is processed by a specific register contained in the SP/LF motor driver to measure the overdrive time and to change the phase.



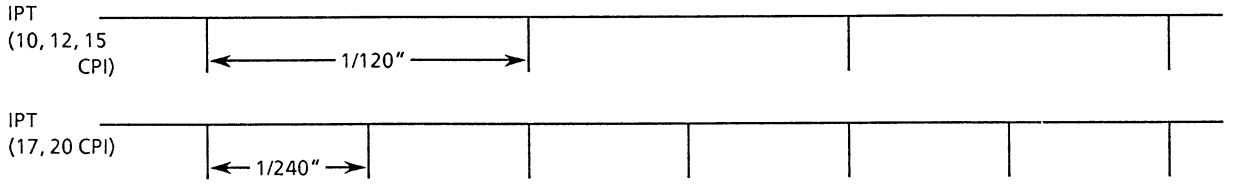
(3) Encoder Disk

In the operation of the spacing motor, the PHASE-A and PHASE-B signals are generated when the encoder disk interrupts the photo sensor.

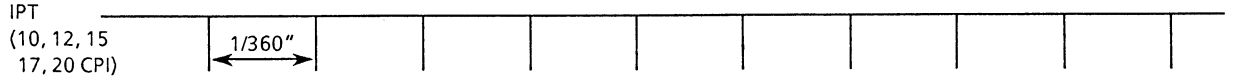
The LSI (02D:MSM79V035) divides these edge pulse signals in accordance with the print pitch, and sends the IPT signal to provide dot-on timing and carriage position detection timing.



- UTILITY MODE

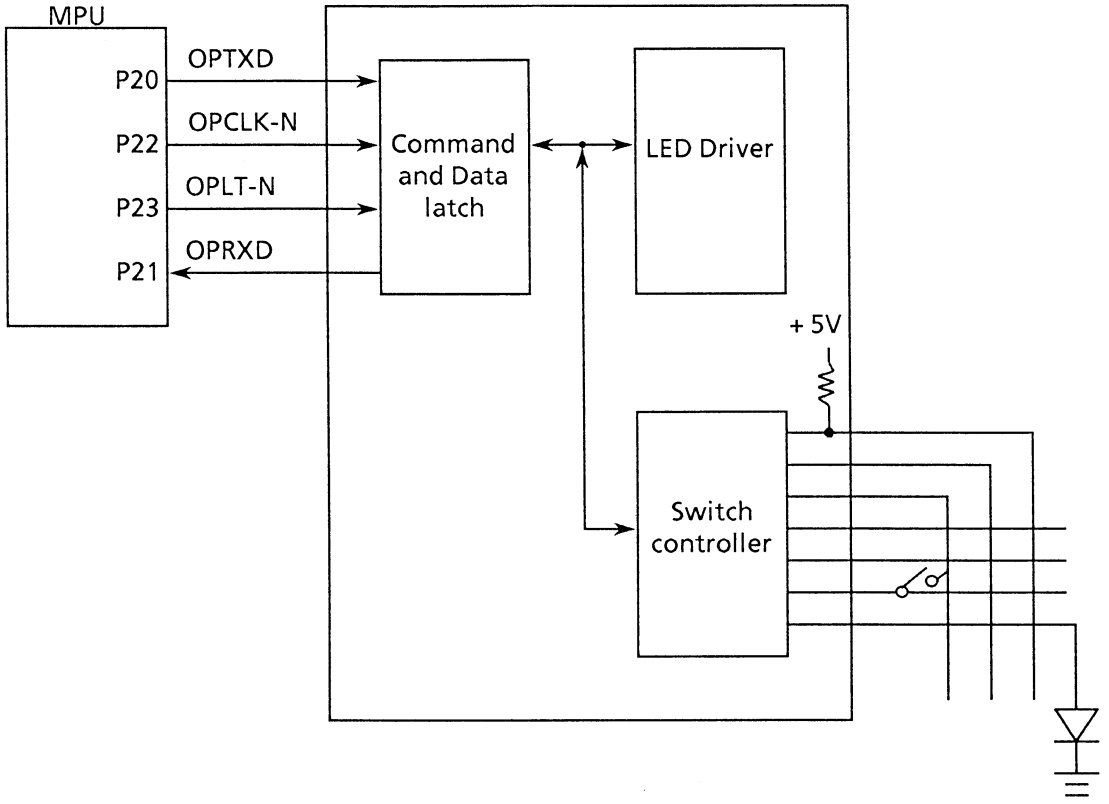


- LQ MODE



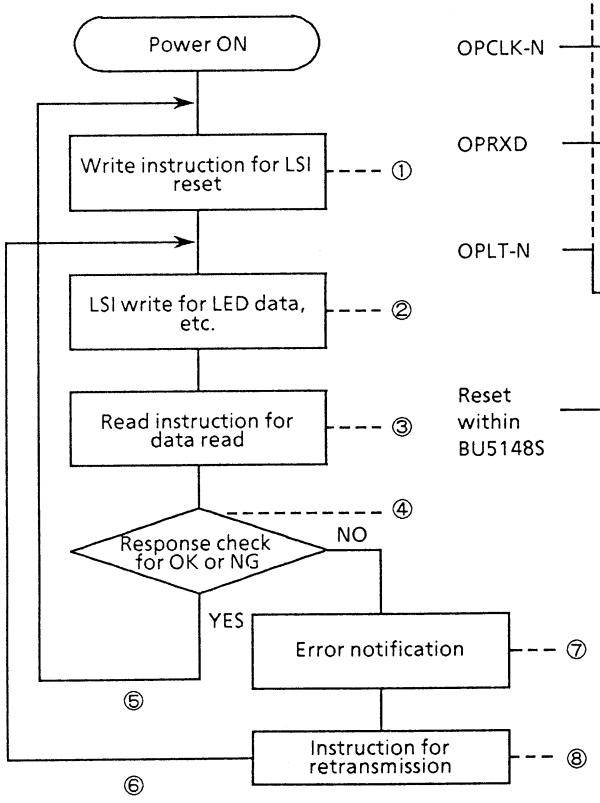
3.1.7 Operation Panel

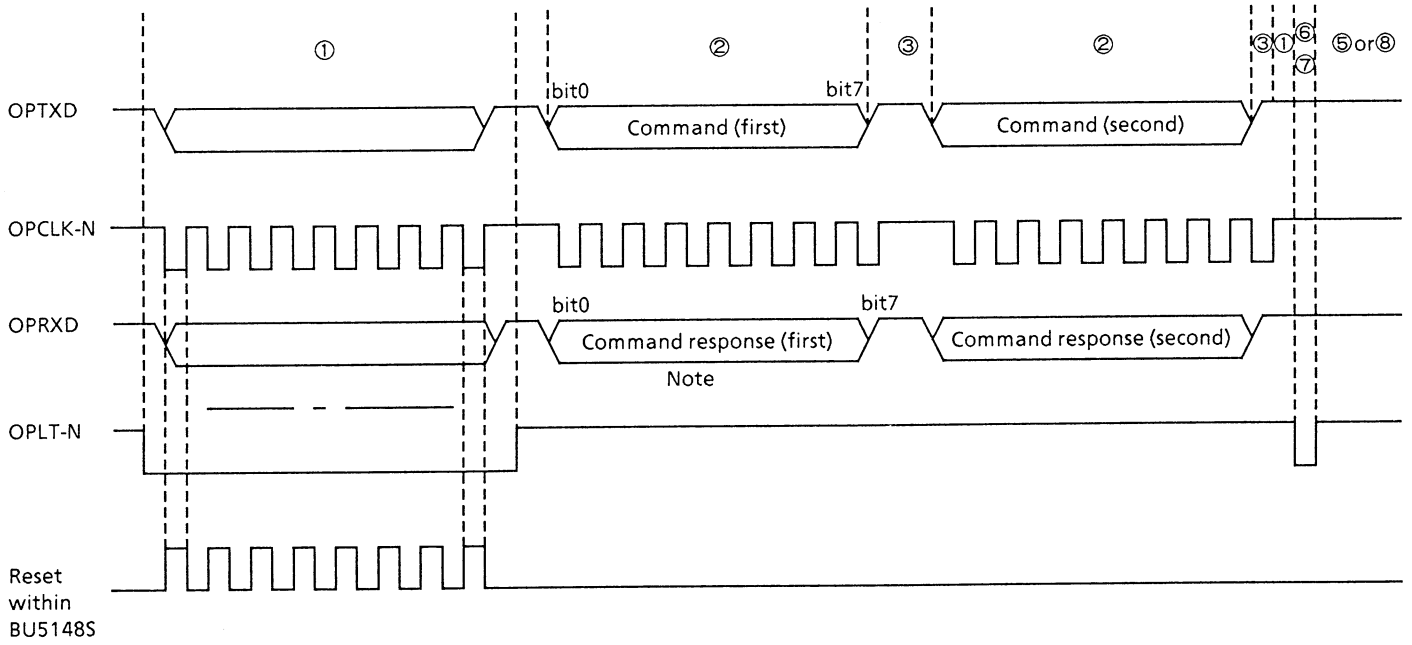
The clock synchronization serial I/O port of the MPU is used to input the switch data and output the LED data through the operation panel control LSI (IC1:BU5148S).



A 2-byte (15 bits + 1 even parity bit) command (OPTXD) is transmitted to the LSI (BU5148S) in synchronization with the OPCLK signal. The LSI decodes this command and when it is found to be legal, returns a 2-byte command response back to the MPU which includes data on Switch information, LED status, receive command ACK/NAK and 1 odd parity bit.

Any transmission errors found cause the command to be reissued after the transmission of the OPLT-N signal.





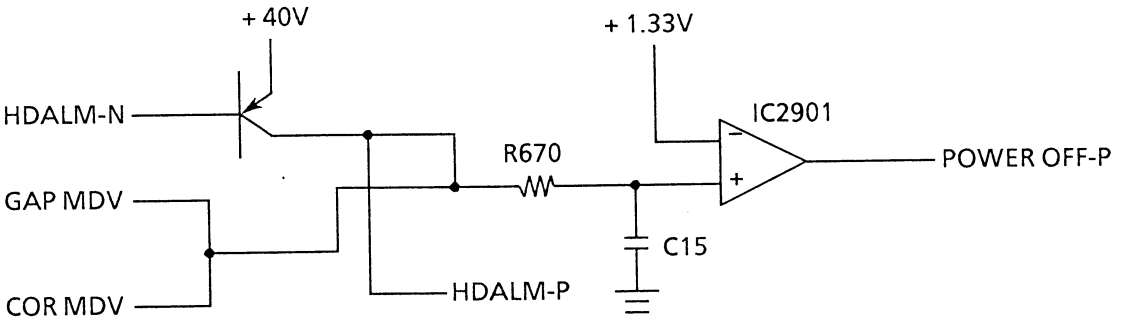
Note : From the illustration above, you can see that the command and the command response are output at the same time. This is because the bit 0 to bit 3 of OPRXD are fixed so that the response can be returned before decoding the command.

3.1.8 Alarm Circuit

(1) Driver circuit alarm processing

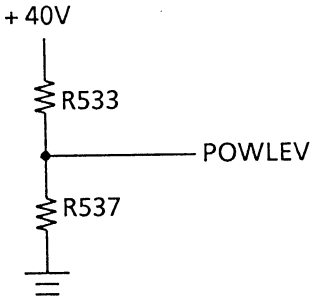
The print head driver output, the head gap magnet output and the colour ribbon magnet drive signal are monitored at R670 and C15, and the power off-P signal is output by the comparator (01A: IC 2901) when driven for more than the specified time. This serves as the power ALM signal to turn off all DC output signals.

Furthermore, the MPU monitors the HDALM-P signal and controls it so that no signal is output when the HDALM-P signal is active.



(2) Alarm processing when DC power is low.

+ 40V is converted into the POWLEV signal (0V to + 5V) by R533 and R537 and input into the A/D port of the MPU to control the drive time and the print speed (pass number) of the head.



(a) Head drive time

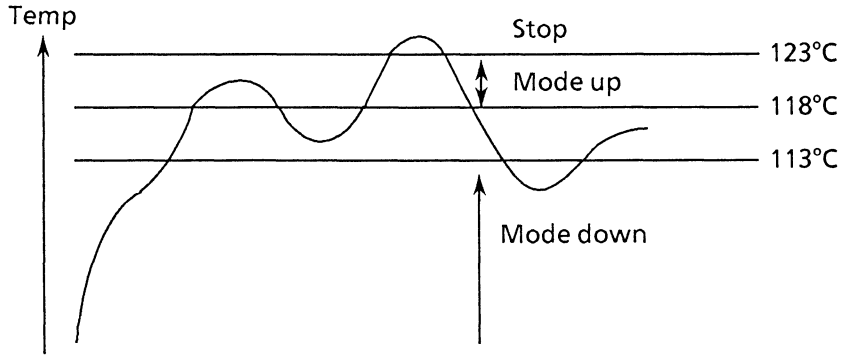
The head drive time is lengthened to compensate for the amount of voltage drop by monitoring the POWLEV signal once every 500 μ sec.to control and maintain the impact necessary for each printing pin at the fixed value.

(b) Print speed

Voltage, + 40V	Pass number	Print speed
37V or more	1 Pass	100%
About 33V to 37V	1 Pass	100~50%
33V or less	2 Pass	50%

(3) Head overheat alarm processing

The voltage of the output TSD signal of the thermistors, one of which is contained in the print head and the other in the print head driver, is monitored by the MPU A/D port to control the voltage.



Mode and print control

Mode	Speed	Pass	Direction	
1	100%	1	Bi	
2	85%	1	Bi	
3	85%	2	Bi	
4	50%	3	Bi	
5	50%	3	Uni	
6	50%	3	Uni	1.5 Sec Stop
(7)	Stop			

- When the temperature is between 118°C and 123°C, the mode switches sequentially to higher level. When the temperature falls below 113°C, the mode switches to lower level.
- When the temperature exceeds 123°C, printing will stop.
- When temperature gradient is steep, higher mode shall be specified directly.

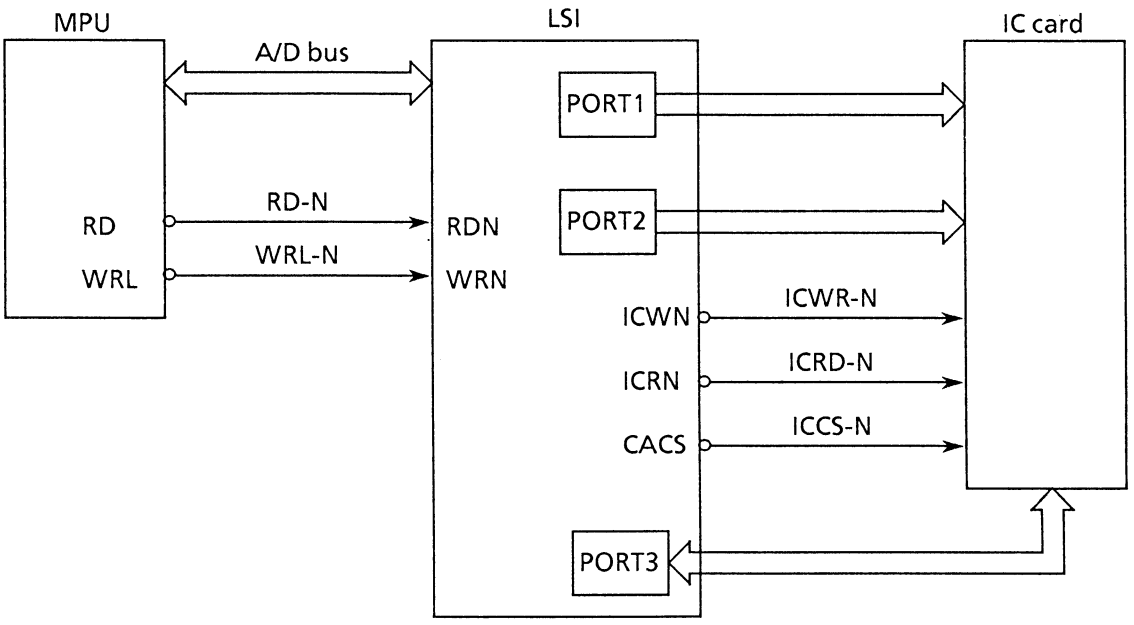
3.1.9 IC Card Control

The IC card is connected to the LSI as shown below.

Port 1 (8 bits) and port 2 (8 bits) of the LSI are the IC card address output ports. Port 1 sets the front address lower bytes of the IC card and port 2 sets its upper bytes by the MPU.

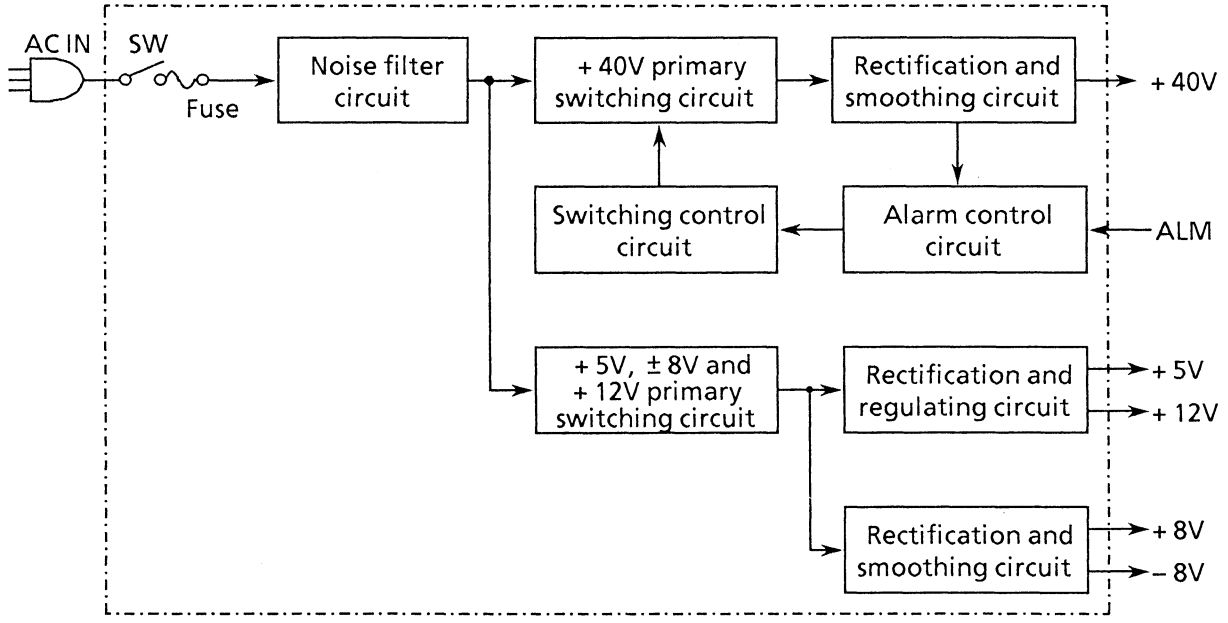
After that, an increment of 1 byte is automatically made for each read or write.

Port 3 is an I/O port, which can be selected by the command from the MPU.



3.1.10 Power Supply Circuit

This switching type power supply circuit supplies the + 5VDC, ± 8VDC, + 12VDC and + 40VDC.



The uses of output voltages and signals are described below.

Voltage/signal	Use
+ 5V	Logic IC/LED drive voltage
+ 8V	Serial interface line voltage and comparator IC
– 8V	Serial interface line voltage
+ 12V	Printhead analog circuit
+ 40V	Printhead, SP motor and LF motor drive voltage
ALM	Output from the control board upon detection of an abnormality in the printhead, gap magnet and colour magnet drive circuit, and shut all DC output off.

Note: + 10V for printhead is generated from + 12V at control board.

3.2 Mechanical Operation

3.2.1 Printhead mechanism and operation (See Figure 3-2.)

The printhead is a spring charged 24-pin driving head using a permanent magnet. It is attached to the carriage, which moves in parallel with the platen. Electrically, this unit is connected to the control circuits through the control board.

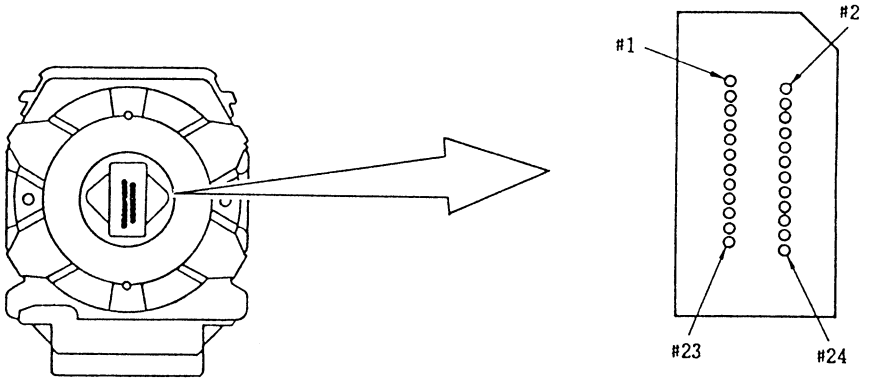


Figure 3-2 Arrangement of the head pins
View from the tip of the printhead

(1) The printhead configuration:

The printhead is composed of the following parts:

(a) Wire guide

(b) Spring assembly (Wire, Armature, Spring, Yoke, Spacer)

(c) Magnet assembly (Magnet, core, coil, Yoke)

(d) Printed circuit board (Print driver, Logic and Analog sensor control, Thermistor)

(e) Fin

(2) Operation of printhead (See Figure 3-3.)

(a) When the printhead is idle, the armature is attracted by a permanent magnet and the spring fixing the armature is compressed. The print wires fixed to each armature are thus concealed under the wire guide.

(b) When a signal for a character to be printed is detected, a current flows through the coil. When the coil is activated, the magnetic flux (caused by the permanent magnet between the armature and the core) is canceled to eliminate the attraction force. The armature is driven in the direction of the platen by the force of the armature spring. The print wire fixed to the armature protrudes from the tip of the wire guide, strikes the paper through the ribbon and prints a dot on the paper.

(c) At this time, when the armature gets nearer to the electrode of the analog sensor, the capacitance between them increases and a small amount of electric current flows.

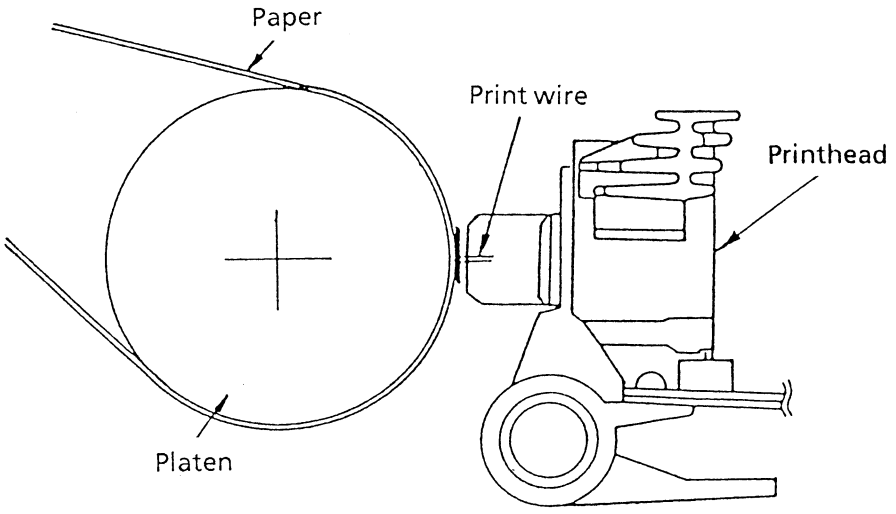
A signal which indicates the armature activity can be generated by amplifying this current.

This signal is fed back to the logic control LSI, and the armature is controlled to be optimum drive time, this process is informed to the MPU. The MPU recognizes the present head gap to maintain it in the optimum condition even when a sheet of paper with a different thickness is inserted.

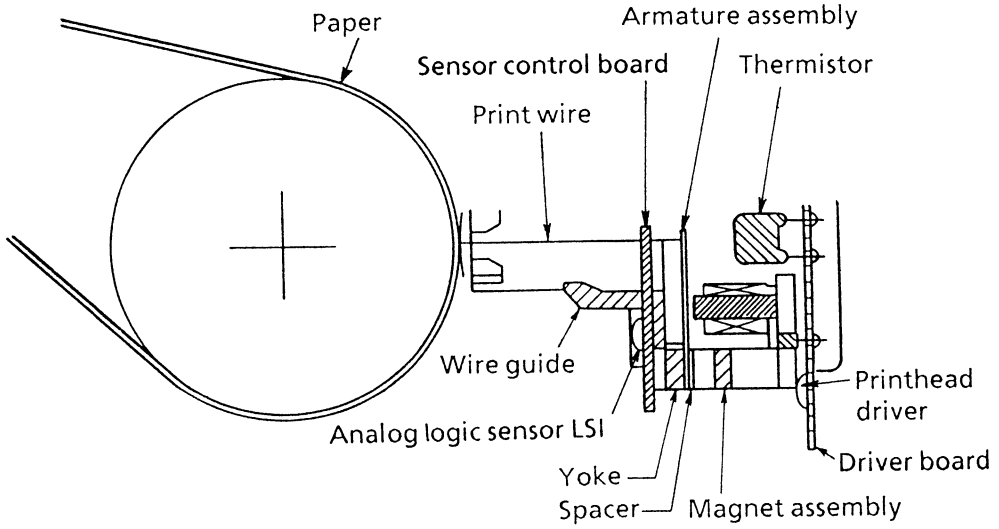
Each pin has its own sensor element. The differences of pin strokes due to the roundness of the platen is recorded by the logic control LSI while measuring the current value of each pin sensor to enable accurate control. Drive time of each pin is controlled by feed back of the sensor signal. This operation is controlled entirely within the print head and not informed to the MPU.

(d) After the character has been printed, the armature is magnetically attracted again and the print wires are again concealed under the wire guide.

A thermistor in the printhead prevents burning caused by over-heating of the coil during extended continuous bi-directional printing. When the temperature of the coil exceeds a pre-determined limit (about 115°C) the control circuit detects a thermistor signal. Printing will then be intermittent or stop completely until the coil temperature falls below the limit value.



(1) When printing



(2) When not printing

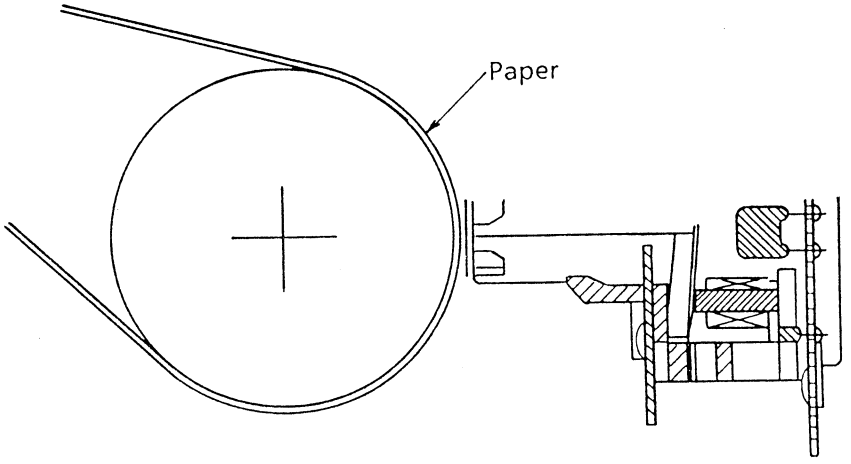


Figure 3-3

3.2.2 Spacing operation (See Figure 3-4.)

The spacing mechanism consists of a carriage shaft mounted in parallel with the platen, and a carriage frame that moves along the shaft. It is driven by a DC motor mounted on the bottom of the carriage frame. Items included in the spacing mechanism are as follows:

(a) DC motor with motor gear

(b) Carriage frame (stationary yoke and motor driver board included)

(c) Carriage shaft

(d) Space rack

(e) Sensor

(f) Encoder disk

(1) Spacing operation

The carriage frame, on which the printhead and space motor are mounted, moves along the carriage shaft in parallel with the platen. When the spacing motor rotates counterclockwise, the driving force is transmitted to the motor gear. As the motor gear rotates, the carriage moves from left to right.

Mechanically, it is designed in such a way that for every revolution of the DC motor, the carriage frame moves 0.8 inch (20.32 mm).

At the same time the encoder disk rotates together with the motor and passes the sensor. The position of the carriage frame can be determined by counting the interrupts detected by the sensor.

In the same way, the rotation of the space motor can be recognized and controlled by measuring the cycle of interrupts detected by the sensor.

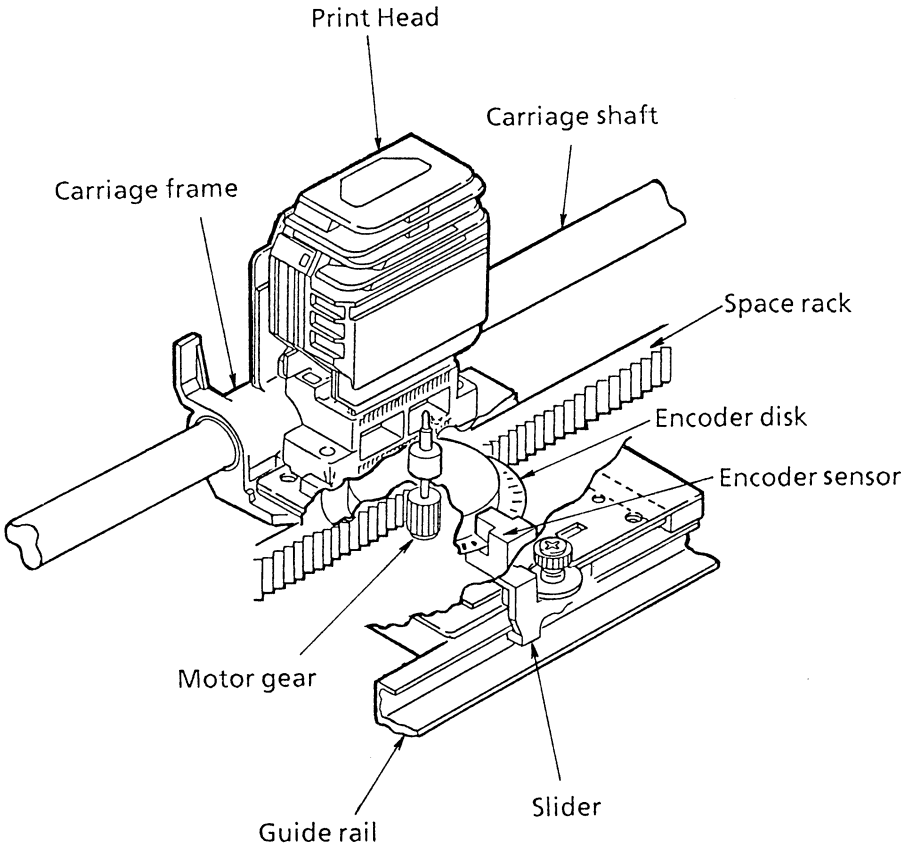

Print Head
Carriage shaft
Carriage frame
Space rack
Encoder disk
Encoder sensor
Motor gear
Slider
Guide rail

Figure 3-4

3.2.3 Head gap setting (See figure 3-5.)

[Mechanism]

(1) Initially, perform the Self-Adjust to store the printing information of the printer head. (This should be executed at factory shipment, head or board or EEPROM replacement or when gap variation is large.)

(2) When the auto gap has been selected in actual printing, the printing information is collected from the first line (or several lines if deficient) of the printed data received.

(3) Printed data is compared with the data stored in Self-Adjust operation to judge the media thickness.

(4) The optimum gap and printing conditions are set according to the media thickness, and subsequent printing is carried out under these conditions.

[Self-Adjust operation procedure]

(1) The Self-Adjust has already been executed at factory shipment, and it should be executed when the print head, control board or EEPROM is replaced or the gap varies.

(2) Set media route to rear (top is available as well), head gap steps to 2, and head gap at this time to 0.35 mm.

(3) Be sure to set ribbon cassette at the paper end condition.

* Press Tear + Quiet SW and turn Power ON. The self-adjust shall be performed automatically.
  → The alarm will be indicated in the following cases: (See Table 7.3)
  - Printhead gap 2 alarm
  - Head gap is too wide or too narrow
  - Printhead gap 1 alarm
  - There is some pin from which the head data cannot be collected

  If alarm occurs, the head gap or printer head will be faulty and no data is stored. In this case, retry after checking the head gap or replacing the head.
  (See 5.2 Printhead Self-Adjust Test.)

* The self-adjust and data renewal shall be performed automatically by only turning Power ON at the paper end condition.
  (In this case, the above mentioned alarm will not be indicated.)

The head gap can select either of the auto gap or the fixed gap by means of the gap control parameters in the menu. So, it is automatically set, without intervention of to the operator, by controlling a pranger magnet and the gear installed in the ribbon feed assembly according to instructions from the MPU.

[Head Gap Setting Procedure]

(1) When printing starts, the space motor operates to rotate the ribbon gear, causing the change gear also to rotate through the idle gear C. (Figure. 3-5 (a))

(2) When the change of the head gap is required by the instruction from the MPU, the armature which holds the change gear is attracted to the pranger magnet pursuant to the gap-p signal by the main P.C.B. The change gear is engaged with the gap change gear by the gap reset spring to rotate the gap change gear. (Figure. 3-5 (b))

(3) The rotation of the gap change gear causes the adjust gear to rotate through the idle gear D installed on the same axle, thus resulting in the setting of a new head gap. (Figure. 3-5 (c))

(4) The gap change gear is provided with a cam. When the change gear comes to the top of the cam, the gear disengages. The moment the rotation of the gear stops, the armature is reset to change the head gap by 1 range.

The head gap is set in the unit of 0.055mm for 1 range according to the number of attractions of the pranger magnet.

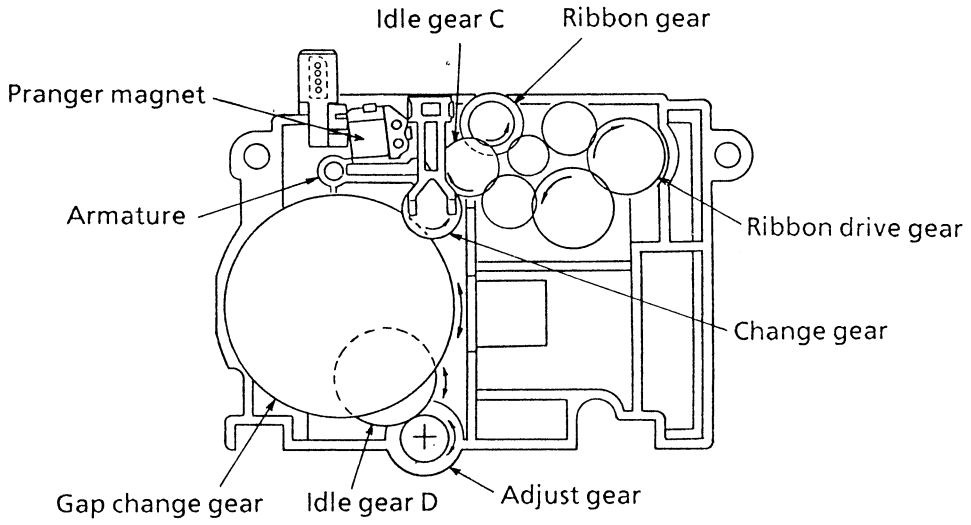


Figure 3-5 (a)

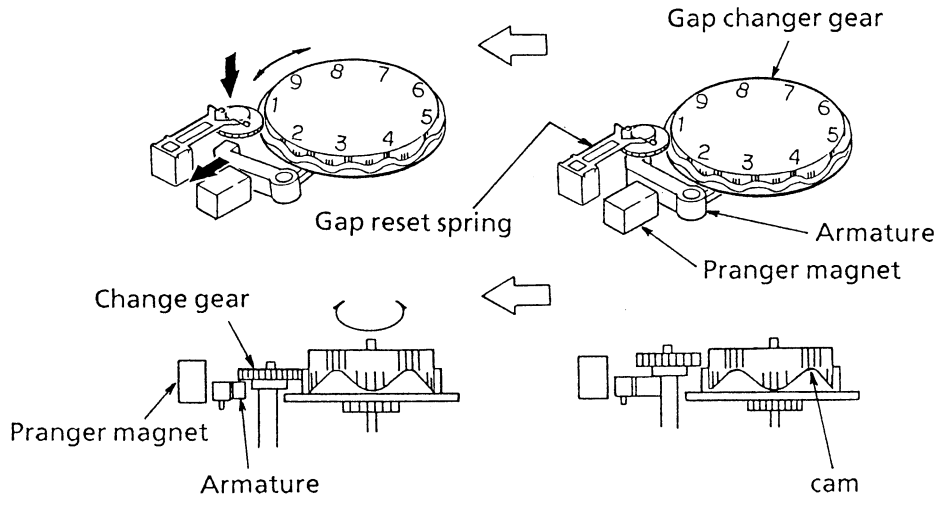


Figure 3-5 (b)

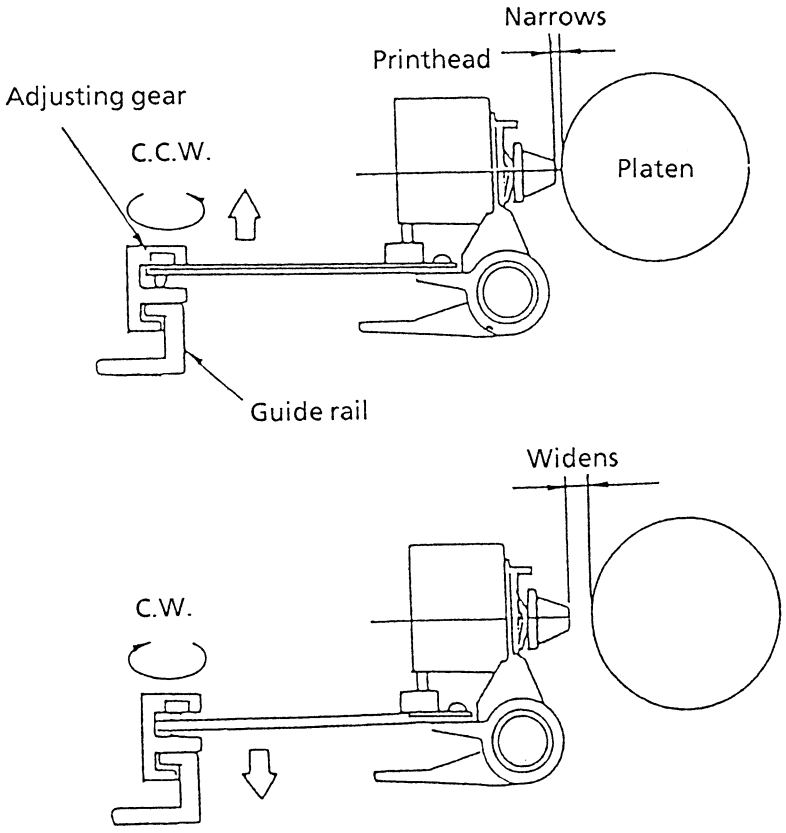

Narrows
Printhead
Adjusting gear
C.C.W.
Platen
Guide rail
Widens
C.W.

Figure 3-5 (c)

3.2.4 Ribbon drive operation (See Figure 3-6.)

[BLACK RIBBON]

The ribbon drive mechanism feeds the ribbon in synchronization with the spacing operation, and the driving force is obtained from the spacing motor.

Items of the ribbon drive mechanism are as follows:

(a) Ribbon drive gear assembly

(b) Ribbon gear (space motor)

(c) Ribbon cartridge

(1) Ribbon cartridge

An endless ribbon with a one way feed is used. Ink is supplied from an ink tank, which is built into the ribbon cartridge.

(2) Drive operation

When the space motor is activated, the ribbon gear on the spacing motor shaft rotates. The rotation is transmitted via a combination of gears from the ribbon drive gear assembly to the drive gear in the ribbon cartridge, thus feeding the ribbon.

Although the ribbon moves in the reverse direction for bi-directional printing, the gears in the ribbon drive gear assembly maintain the same feed direction of the ribbon by switching the rotation direction of the gears.

[BLACK RIBBON]

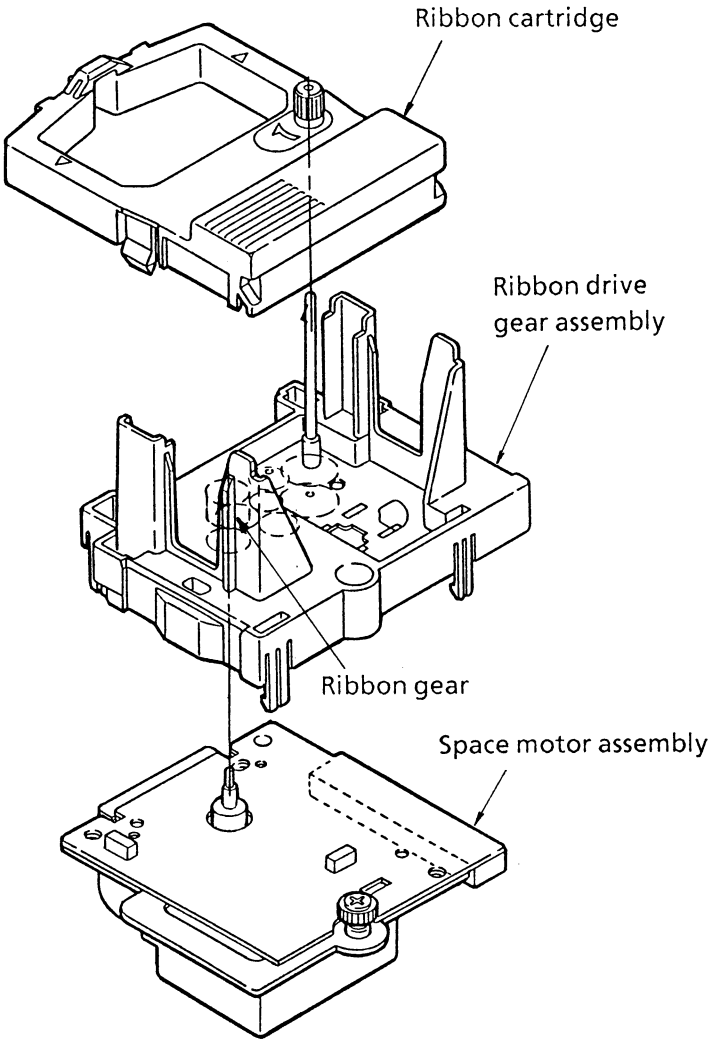


Figure 3-6 (a)

[COLOUR RIBBON] (OPTION)

(1) Composition of colour ribbon unit option

a. Shift unit

b. Colour ribbon (4 colours)

(2) Drive operation (See Figure. 3-6 (c))

Four kinds of colours can be selected by sliding the colour ribbon holder up and down by driving the pranger magnet in the shift unit.

a. The change gear is driven through the colour idle gear by the gear C in the ribbon drive gear assembly.

b. When the pranger magnet is activated by the colour-P signal from the main control board, the armature is attracted and the change gear is forced down by the reset spring. Consequently, the colour change gear is driven to move the colour ribbon holder up and down by the rotation of the colour cam shaft so that any desired colour can be selected.

c. When the change gear comes to the top of the cam, it is disengaged from the colour change gear to stop its rotation, and holds the present colour until the pranger magnet turns on according to the next instruction of the colour selection.

[COLOUR RIBBON] (OPTION)

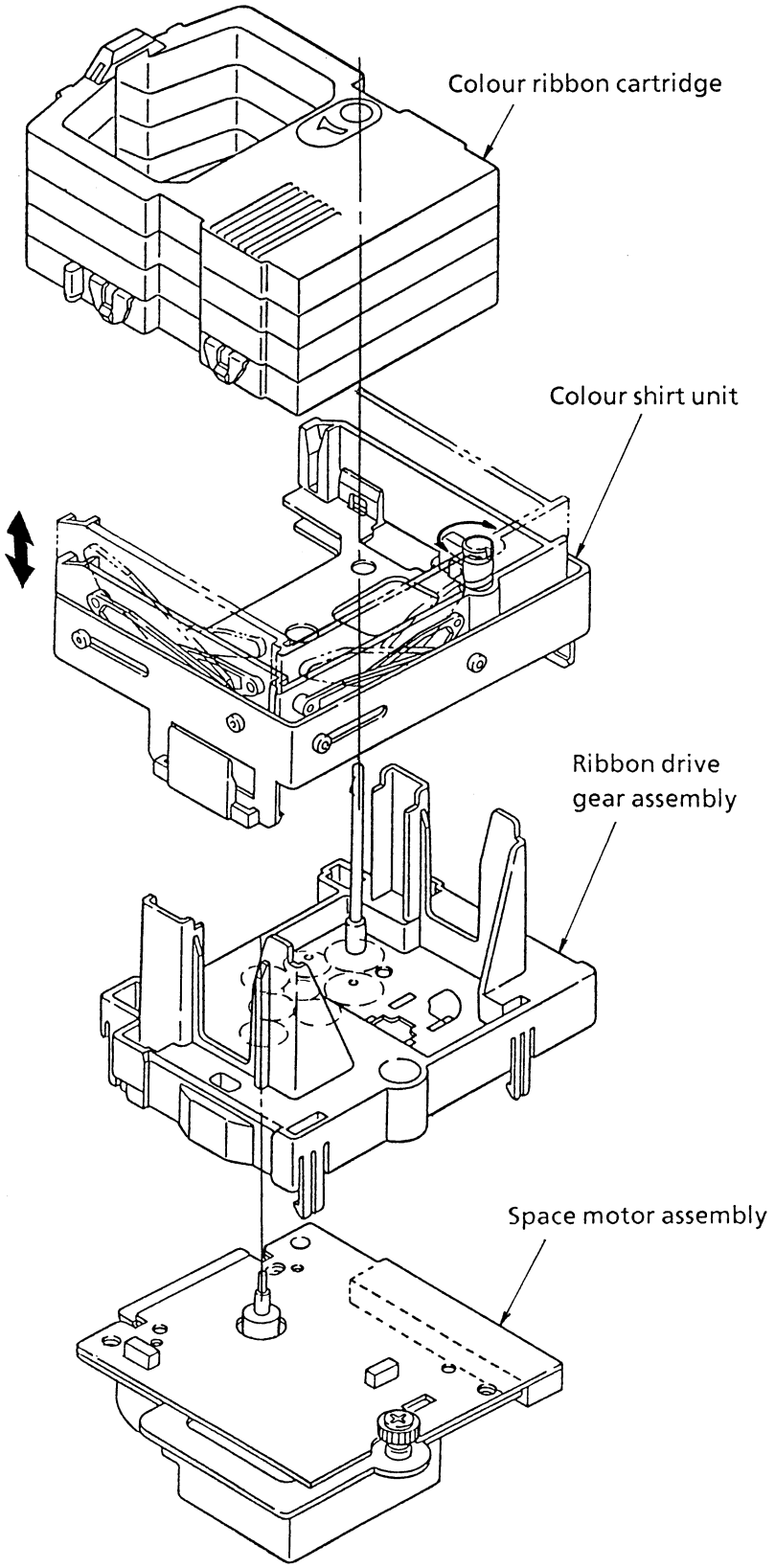


Figure 3-6 (b)

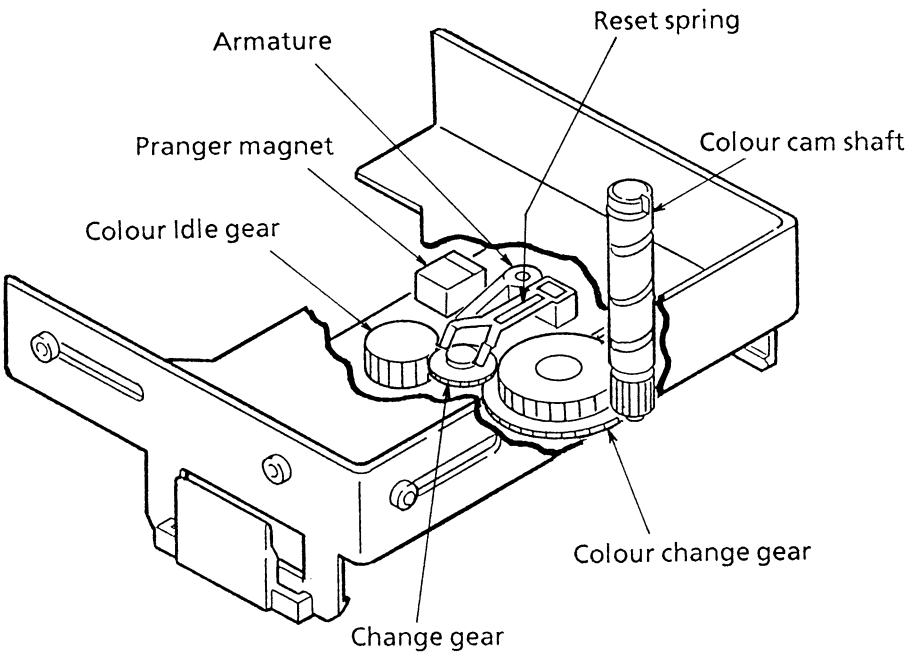

Armature
Reset spring
Pranger magnet
Colour cam shaft
Colour Idle gear
Colour change gear
Change gear

Figure 3-6 (c)

3.2.5 Paper feed operation

Feeding of the paper is performed by turning the platen and the pin tractor, which is driven by the LF pulse motor.

Item of the paper feed mechanism are as follows:

(a) Pulse motor with gears

(b) Decelerating gear

(c) Platen

(d) Tractor feed unit

(e) Pressure roller

(1) Cut sheet and continuous sheet switching mechanism (See Figure 3-8.)

Three different paper paths can be selected and set by the change lever.

(a) TOP (for cut sheet)

When the cut sheet is used in the manual mode or fed by the CSF (option), set the change lever at the position marked TOP.

[Operation]

The driving force of the platen gear (R) is transmitted to the idle gear by setting the change lever to the TOP position. However, this causes the idle gear to be disengaged from the change gear, leaving it free.

At this time, the pressure rollers (at the rear and the front) are pressed securely to the platen to feed the cut sheet. At the same time, the cut sheet detection lever turns on the cut sheet detection switch, to confirm to the control board that you are in the cut sheet mode.

In the cut sheet mode, the control board automatically feeds the sheet up to the print start position after pausing for the wait time stored in the menu.

(b) REAR (Continuous sheet from push tractor)

When the change lever is set to REAR position, the change gear is engaged with the idle gear and the tractor gear to transmit the rotation of the platen to the push tractor shaft, and the continuous sheet is fed from the push tractor.

(c) BOTTOM (Continuous sheet from bottom feeder) (option)

When the change lever is set in the BOTTOM position, the rotation of the platen is transmitted to the drive gear of the bottom tractor feed unit through the idle gear to feed the sheet which has been set in the bottom tractor feed.

Correlation in Mechanism

Mechanism / Lever position	Cut sheet detection SW	Idle gear	Change gear	Tractor gear	Front pressure roller	Sheet insertion
TOP	ON	Rotate	Stop	Stop	ON (Tension 380g)	Manual/ automatic CSF: Operation SW or instruction
REAR	OFF	Rotate	Rotate	Rotate	ON (Tension 90g)	· Operation SW or · instruction
BOTTOM	OFF	Rotate	Rotate	Stop	Free	· Operation SW or · instruction

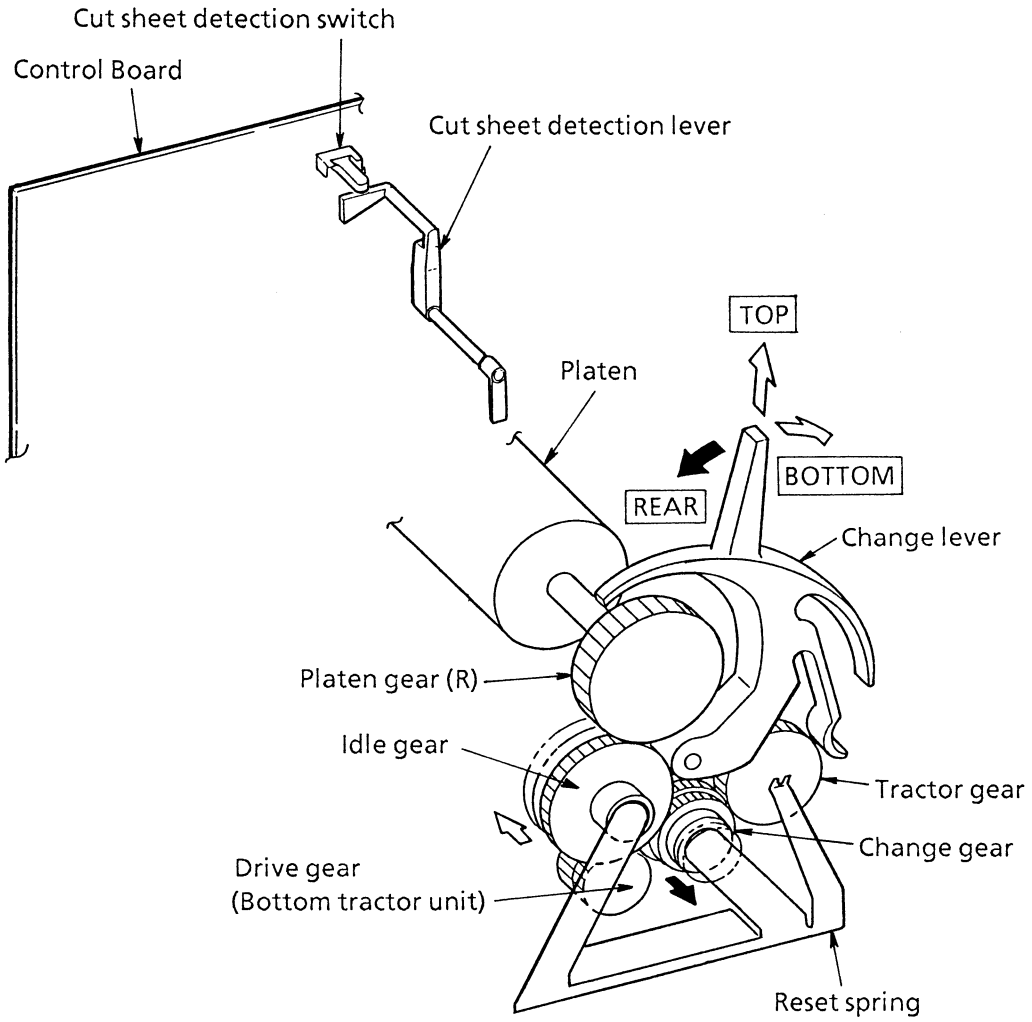

Cut sheet detection switch
Control Board
Cut sheet detection lever
TOP
Platen
BOTTOM
REAR
Change lever
Platen gear (R)
Idle gear
Tractor gear
Change gear
Drive gear
(Bottom tractor unit)
Reset spring

Figure 3-8

(2) **Cut-sheet feed operation (See Figure 3-9.)**

The pulse motor used for the paper feed mechanism is mounted on the left of the frame, and the rotation of the motor is transmitted through decelerating gears (LF idle gear, platen gear) to the platen. When using cut-sheet paper, the change lever must be in the [TOP] position to grab the paper, while disengaging the push tractor.

When the change lever is set to the [TOP] position, the cut sheet is automatically fed in up to the print start position after pausing for the wait time stored in the menu.

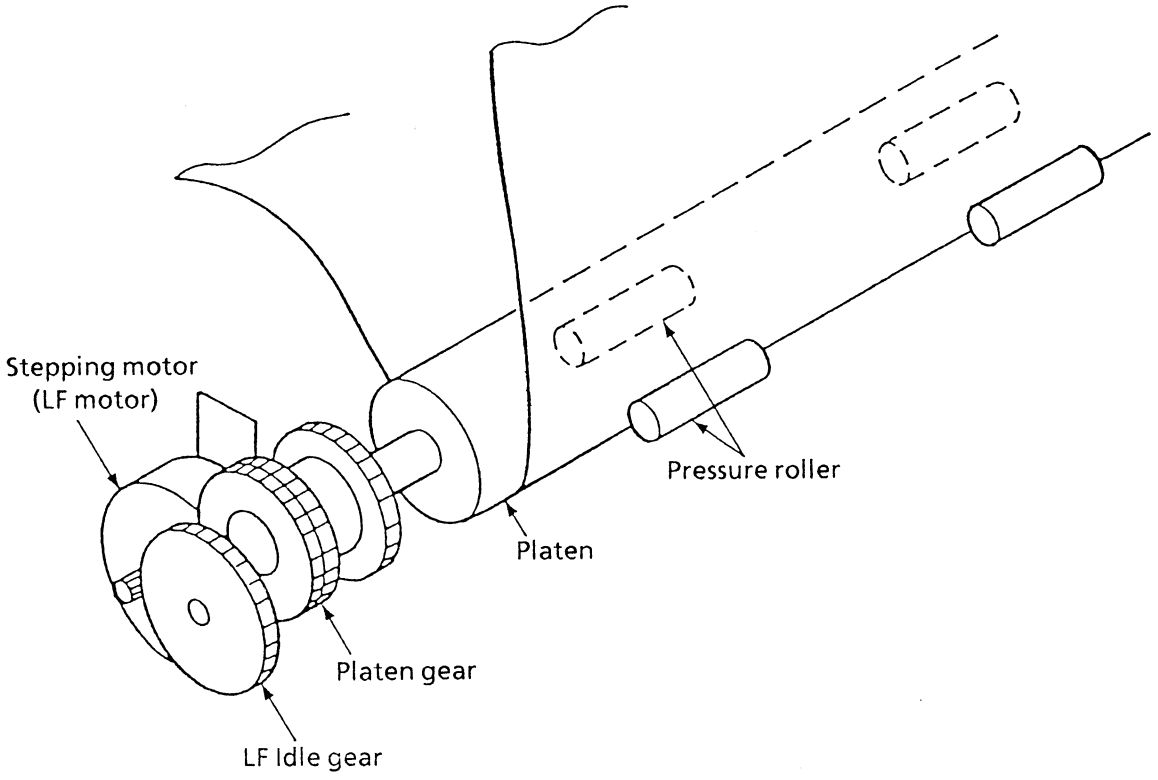


Figure 3-9

(3) Continuous paper feed operation (Rear) (See Figure 3-10.)

The force transmitted to the platen, rotates the tractor gear through platen gear, the idler gear and the change gear. The rotation of the tractor gear makes the pin tractor belt rotate through a sheet feeder shaft, feeding the continuous paper.

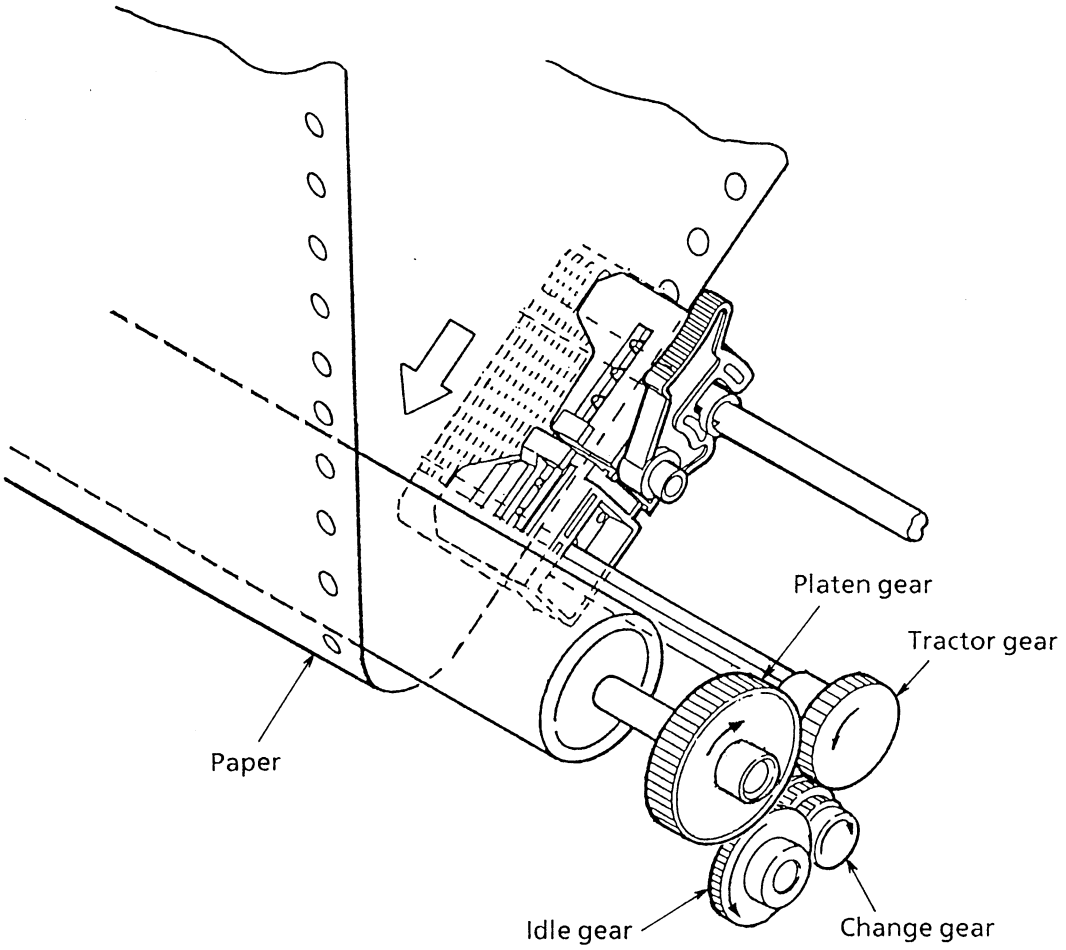


Figure 3-10

(4) Push and pull tractor mechanism (Option) (See Figure 3-11.)

This mechanism consists of an optional pull tractor and a standard push tractor mechanism. This mechanism can perform forward and reverse feed by setting continuous sheets to the push tractor and pull tractor.

The rotation of the platen is transmitted to the push tractor and the pull tractor. Sheets are fed by these two tractors at the same time.

To remove slack from the sheets, set the sheets according to the following procedure when using the push and pull tractors.

① Set the change lever to the REAR position (setting the sheets to the push tractor to feed).

② Set the paper, which is fed in front of the platen, to the pull tractor.

③ Set the change lever to the TOP position and feed paper using the platen knob.

④ If paper slack is removed, set the change lever to the REAR position.

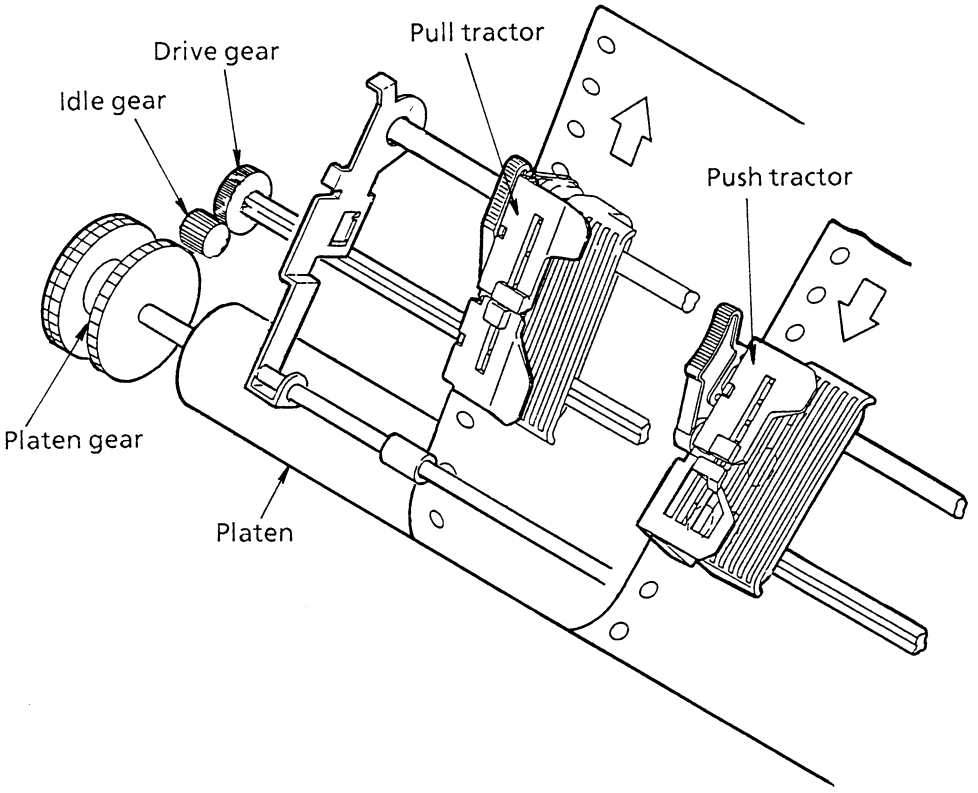


Figure 3-11

(5) Pull tractor mechanism (option) (See Figure 3-12.)

Bottom feed of continuous sheets is possible only when an optional pull tractor unit is installed.

The rotation of the platen is transmitted to the idle gear of the pull tractor unit through the platen gear at the left end of the platen. The rotation of the idle gear is transmitted to the drive gear, and continuous sheet forms are fed by the pull tractor being rotated through the sheet feeder shaft.

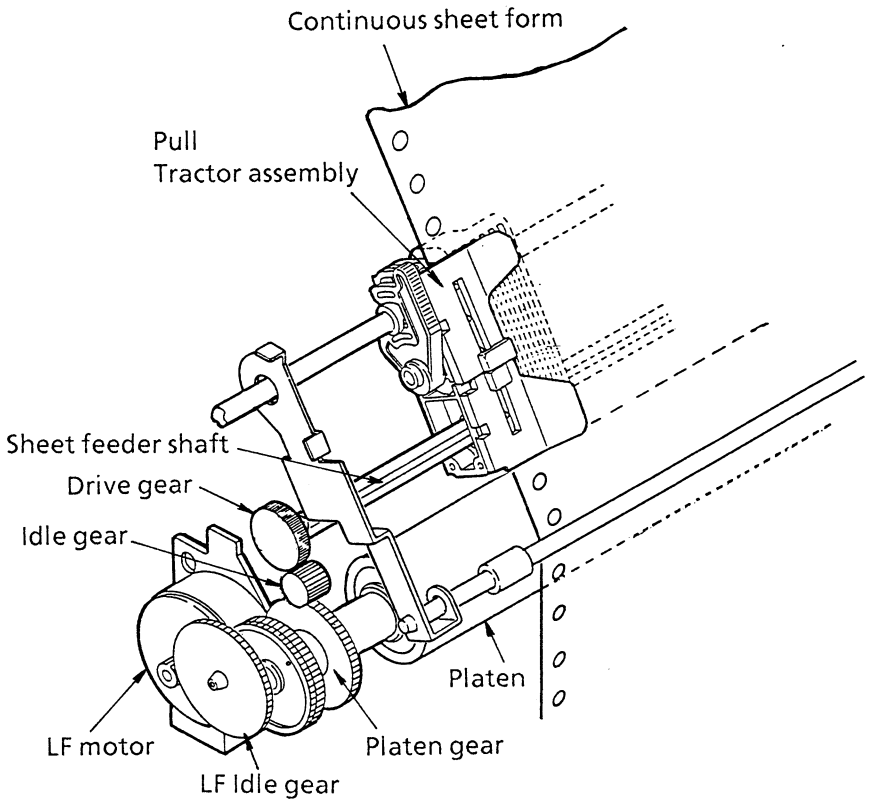


Figure 3-12

(6) **Bottom push feed operation (option) (See Figure 3-13.)**

The bottom push feed of the continuous sheet is possible only when the bottom tractor feed unit is installed.

When the platen rotates, the rotational force of the platen is transmitted through the tractor idle gear and the tractor change gear to the tractor drive gear of the bottom push tractor, and the sheet of paper is fed in to the print start position.

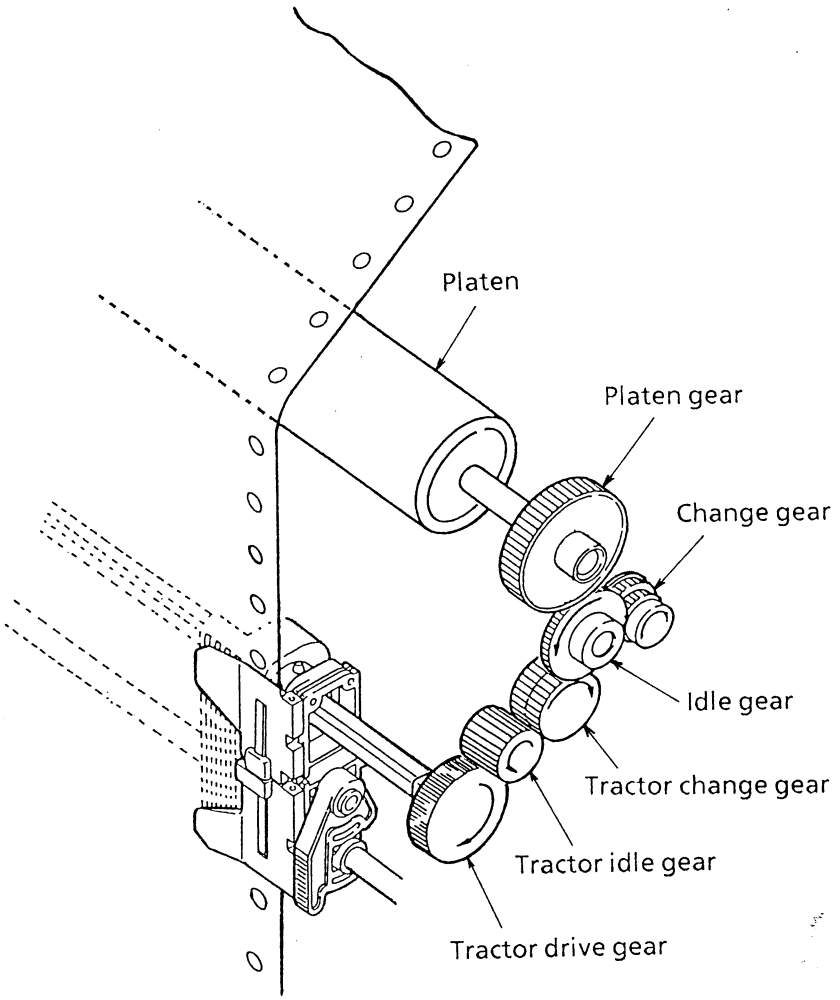


Figure 3-13

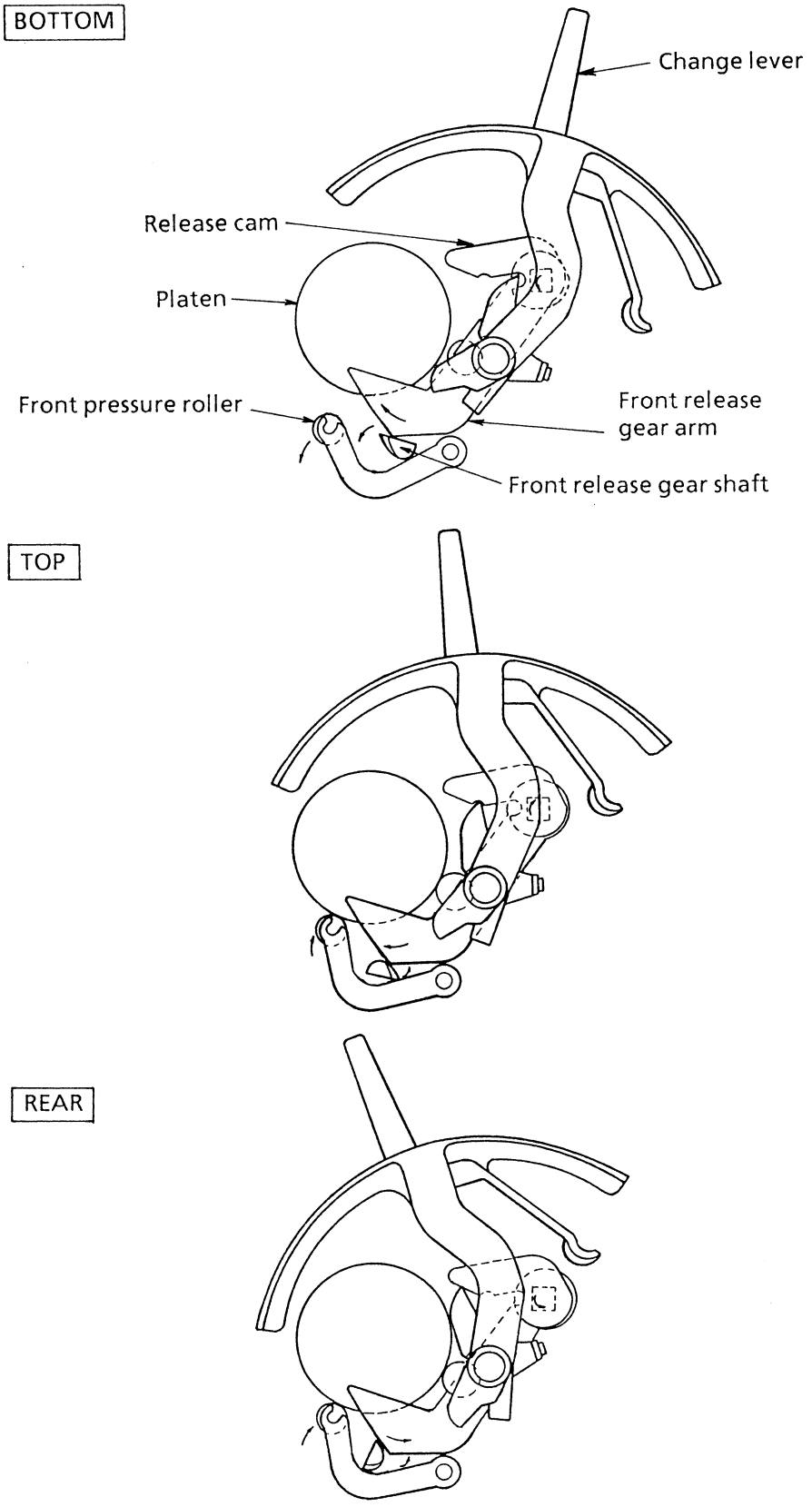

BOTTOM
Change lever
Release cam
Platen
Front pressure roller
Front release
gear arm
Front release gear shaft
TOP
REAR

Figure 3-14

(7) **Paper clamp mechanism (See Figure 3-14.)**

When setting the change lever to the BOTTOM, TOP or REAR position, the operation of the front release gear arm changes according to the position of the release cam. And at the same time, the position of the cam installed to the front release gear shaft changes, and the open and close of the pressure roller and its tension also changes.

Position of change lever	Open or close of pressure roller	Tension of Pressure roller	Tension of Rear Pressure roller
BOTTOM	OPEN	—	—
TOP	CLOSE	380g	700g
REAR	CLOSE	90g	—

3.2.6 Paper detection mechanism (See Figure 3-15.)

(1) Cut sheet detection

When the cut sheet is inserted, the point A is pushed backward and the paper near end lever B rotates counter clockwise (CCW).

At this time, the rear sensor lever rotates counterclockwise (CCW), the rear sensor lever and pulls out of the rear and top paper end sensor to detect that the sheet is provided.

The procedure for the paper end is made in the reverse order, that is, its detection is performed when the paper end sensor is blocked.

(2) Rear feed detection

When the sheet is fed from the push tractor, the point B is pushed to the front side and the paper near end lever A rotates clockwise (CW). At this time, the rear sensor lever rotates counterclockwise (CCW), and pulls out of the rear and top paper end sensor to detect that the sheet is provided.

The procedure for the paper end is made in the reverse order, that is, its detection is performed when the rear sensor lever intercepts the sensor.

(3) Bottom feed detection

When the sheet is fed from the bottom, the point C rotates clockwise (CW). When the bottom sensor lever rotates clockwise (CW), it pulls out of the bottom paper end sensor to detect that the sheet is provided.

The procedure for the paper end is made in the reverse order, that is, its detection is performed when the bottom sensor lever intercepts the sensor.

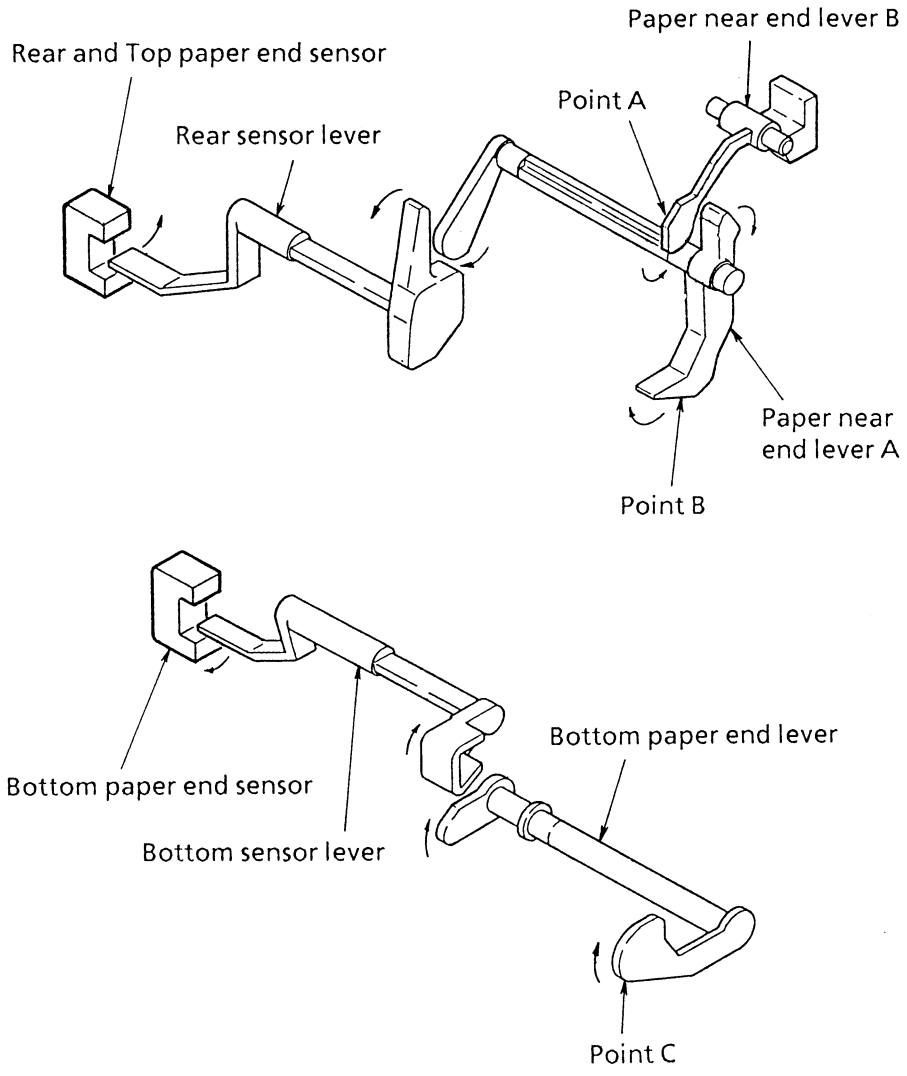

Paper near end lever B
Rear and Top paper end sensor
Point A
Rear sensor lever
Paper near
end lever A
Point B
Bottom paper end lever
Bottom paper end sensor
Bottom sensor lever
Point C

Figure 3-15

(4) Top line print mechanism (See Figure 3-16.)

When the control board is set to feed a new sheet, the print head moves to the left bracket position, the latch of the stored support protector is released, and moves to the position to support the fed sheet.
The front edge of the sheet is protected by the ribbon protector and the support protector so that it can stop at a position just near to the print head (0 tear off position) to start printing at the front end of the sheet, without causing the sheet to crumple or curl up.

The printing starts at the front end of the sheet, and continues bi-directionally until the front end of the sheet gets to the inside of the pull up roller cover.

The print head then moves about 5mm short of the left bracket and the support protector is latched and stored. After that, the printing continues bi-directionally.

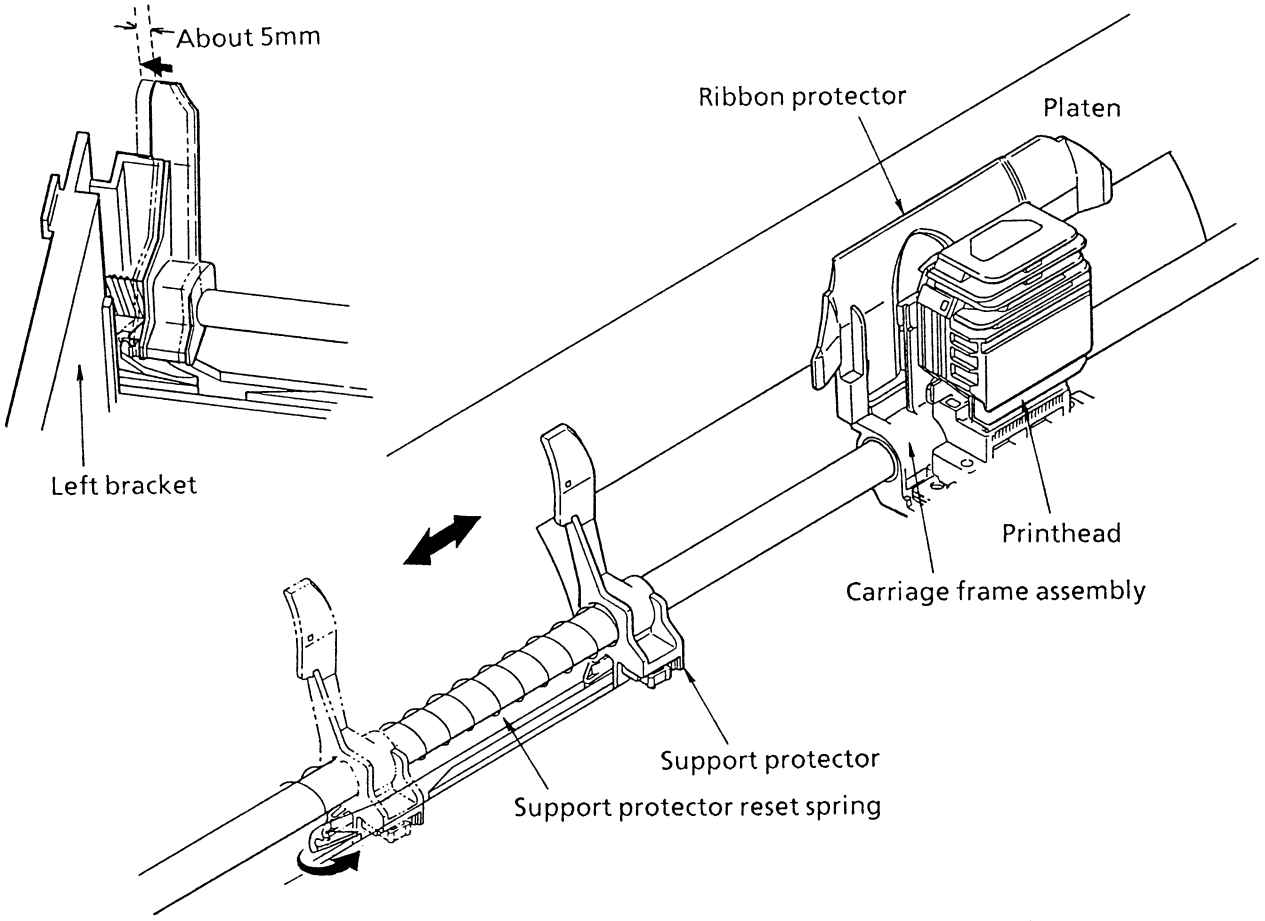

About 5mm
Ribbon protector
Platen
Left bracket
Printhead
Carriage frame assembly
Support protector
Support protector reset spring

Figure 3-16

3.2.7 Automatic sheet feed

This function is used to feed in the sheet automatically up to the print start position when the cut sheet or the continuous sheet is used.

[Operational procedure]

(1) When using the cut sheet

1) Set the change lever to the Top position. (See Figure. 3-17.)

2) Insert a sheet of paper between the platen and the paper shoot.

3) After the lapse of time selected by the "wait time" in the menu, the LF motor starts its operation to feed the sheet of paper up to the print position.

4) When the default is selected, the sheet of paper is feed in up to the position 0.35 inches (first dot position) from the upper end of the sheet. However, the 0 tear off mechanism allows the printing at the front end of the sheet by changing the TOF position.

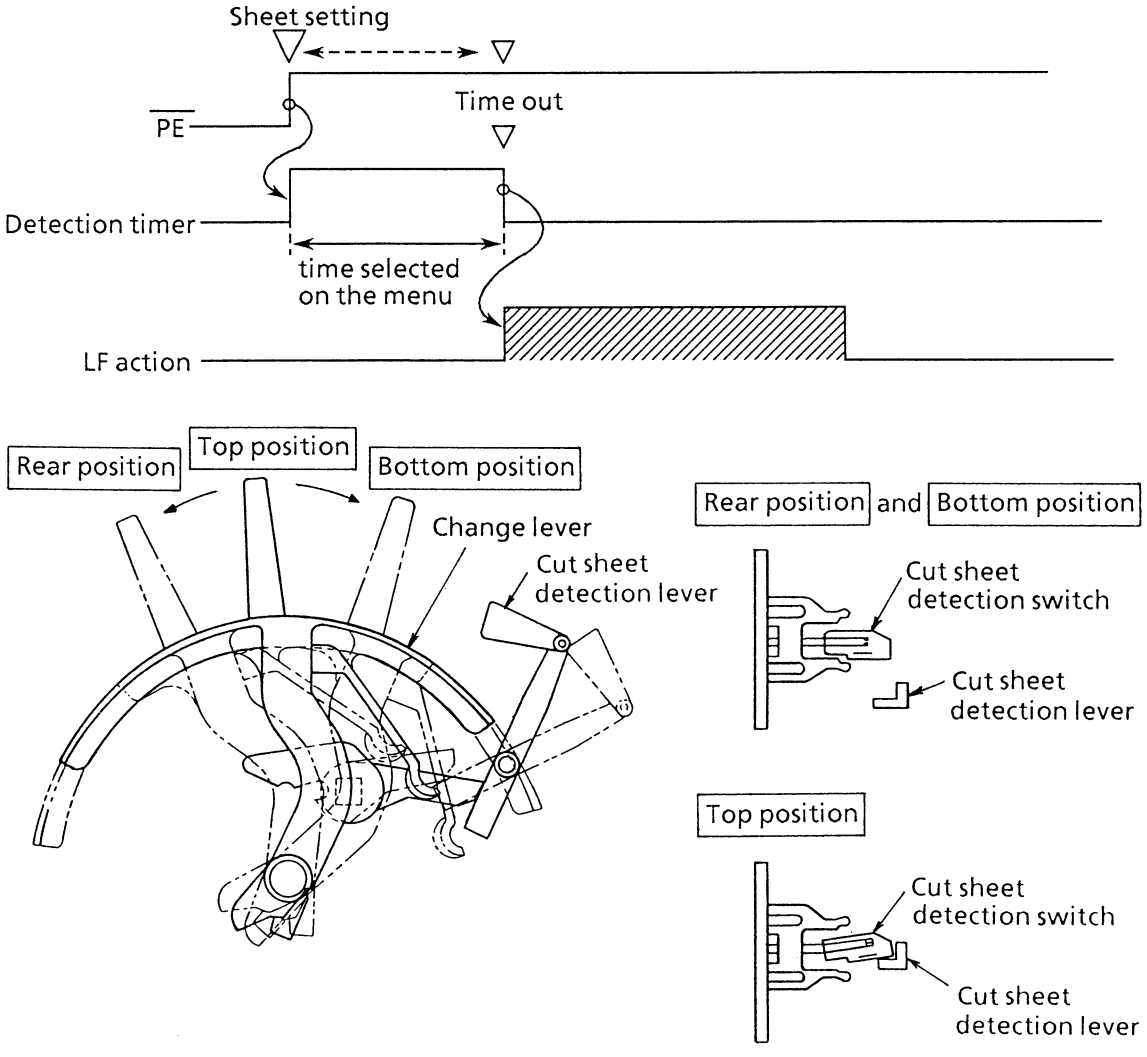


Figure 3-17

(2) When using the continuous paper

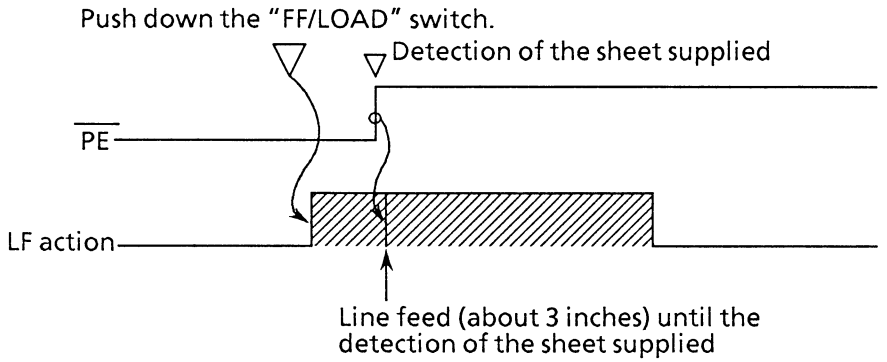
1) Set the change lever either to the rear side or the bottom side position. (See Figure. 3-17.)

2) Set a sheet of paper either to the push tractor or the bottom tractor.

3) Press the "FF/LOAD" switch.

4) The LF motor starts its operation to feed the paper up to the print start position.

5) The paper is fed in up to the TOF position (Factory default: 0.35 inches from the top).



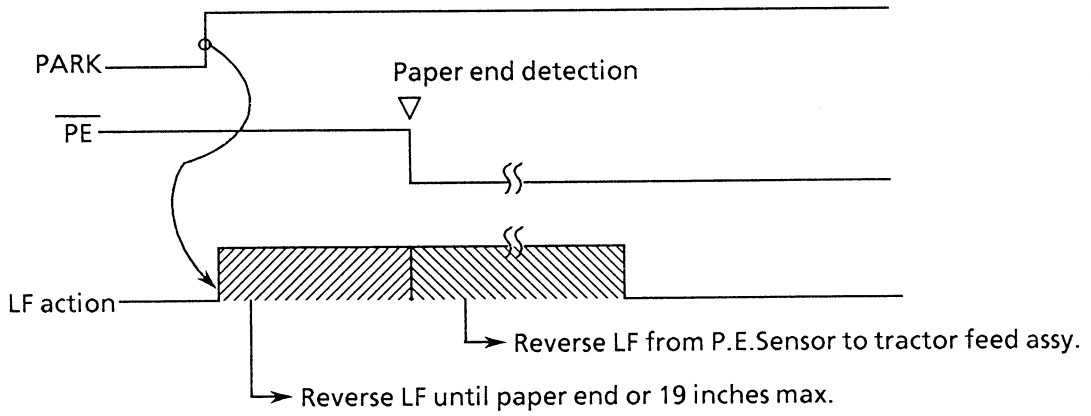
When the "FF/LOAD" switch is pushed down, the LF motor feeds in the sheet about 3 inches. When the LF motor completes the operation and the sheet has not been fed in, the feeding operation becomes ineffective, thus resulting in the feeding jam.

3.2.8 Paper park function (continuous paper)

Continuous sheets which have been inserted can be reversed automatically by using the "PARK" button on the operation panel.

Its operation is as follows:

1) Press the "PARK" button on the operation panel.
2) Reverse LF is started and paper is fed in reverse until paper end occurs or 19 inches maximum have been fed.
3) The paper is fed in reverse, to leave the paper on the push-tractor or bottom-tractor.



Alarm LED lights up when P.E. is not detected after 19 inches reverse feeding.

Operator can press SEL key to turn off the ALARM LED then press PARK key to continue park function.

This operation is required when the length of paper for parking is more than 19 inches.

4. ASSEMBLY/DISASSEMBLY

4. ASSEMBLY/DISASSEMBLY

This section explains the procedures for removing and installing various assemblies and units in the field.

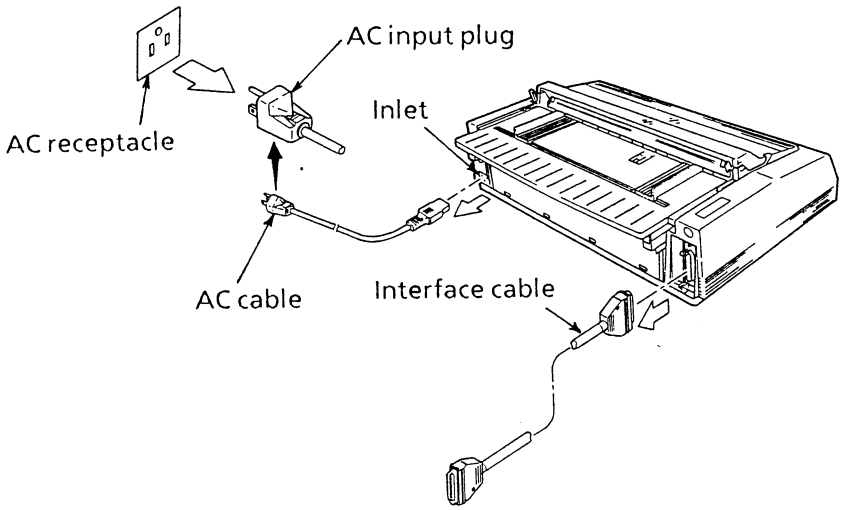
Description is mainly limited to the removal procedure; installation should basically be performed in the reverse sequence of the removal procedure.

4.1 Precautions for Parts Replacement

(1) Remove the AC cable and the interface cable before disassembling or assembling.

(a) Turn off the AC power switch. Remove the AC input plug of the AC cable from the receptacle. Remove the AC cable from the inlet on the printer.

(b) To connect the AC cable again, connect it to the inlet on the printer first, then insert the AC input plug into a receptacle.



(2) Do not disassemble the printer as long as it is operating normally.

(3) Do not remove unnecessary parts, and limit the disassembly area as much as possible.

(4) Use the designated service tools.

(5) Carry out disassembly in the prescribed sequence; otherwise, damage to the parts may result.

(6) It is advisable to temporarily install screws, snap rings and other small parts in their original positions to avoid losing them.

(7) Whenever handling the microprocessors, ROM, RAM IC chips and boards, do not use gloves which may cause static electricity.

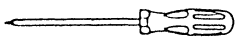
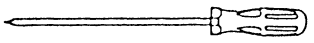
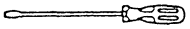
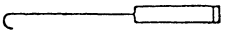
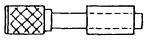
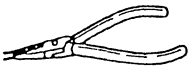
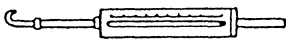
(8) Do not place the printed circuit board directly on the equipment or on the floor.

(9) If adjustment is specified in the middle of installation, follow the instructions.

4.2 Service Tools

Table 4.1 lists the tools necessary for replacing printed circuit boards and parts of units in the field.

Table 4.1 Service tools

No.	Service tool		Q'ty	Use	Remarks
1		No. 1-100 Phillips screwdriver	1	Screws 2.6 mm	
2		No.2-200 Phillips screwdriver	1	Screws 3-5 mm	
3		No. 3-100 screwdriver	1		
4		Spring hook	1		
5		J-YX4025-8335-3	1	Head gap adjustment	
6		Volt/ohmmeter	1		
7		Feeler gauge	1	Head gap adjustment	
8		Pliers	1		
9		No. 5 nippers	1		
10		1.1 lbs(500 g) bar pressure gauge	1		

4.3 Disassembly/Reassembly Procedure

This section explains the assembly replacement procedures according to the following disassembly system.

[Parts Layout]

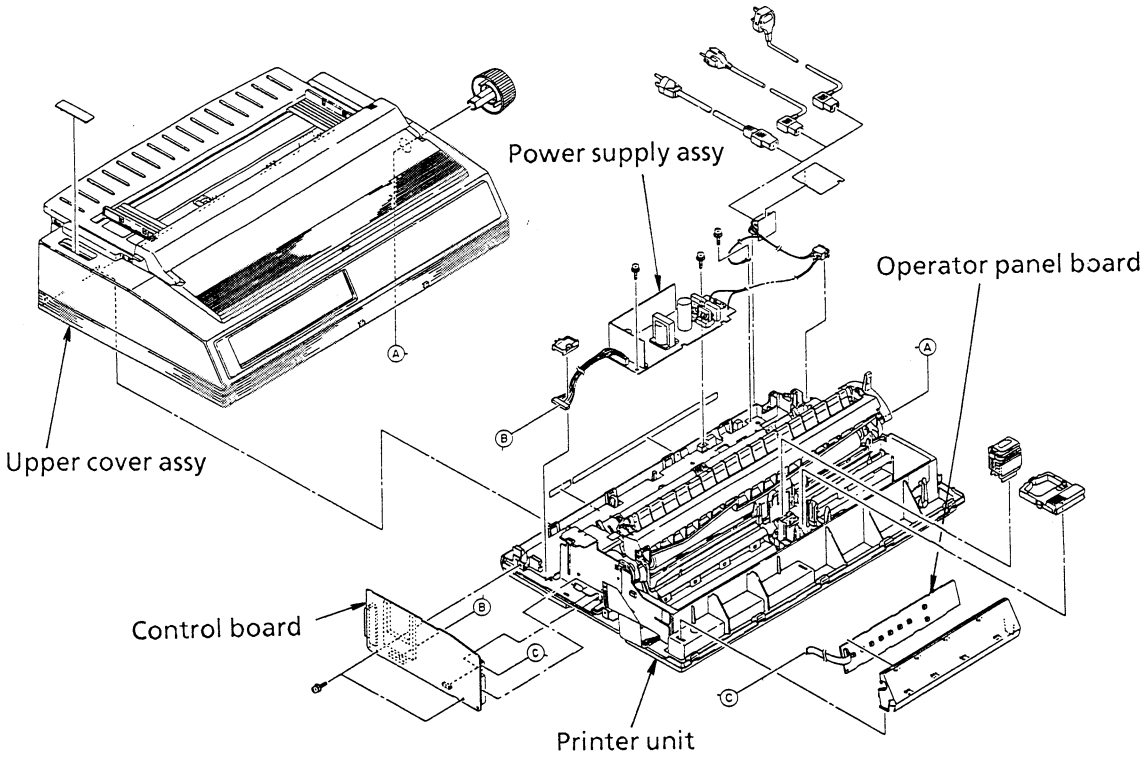
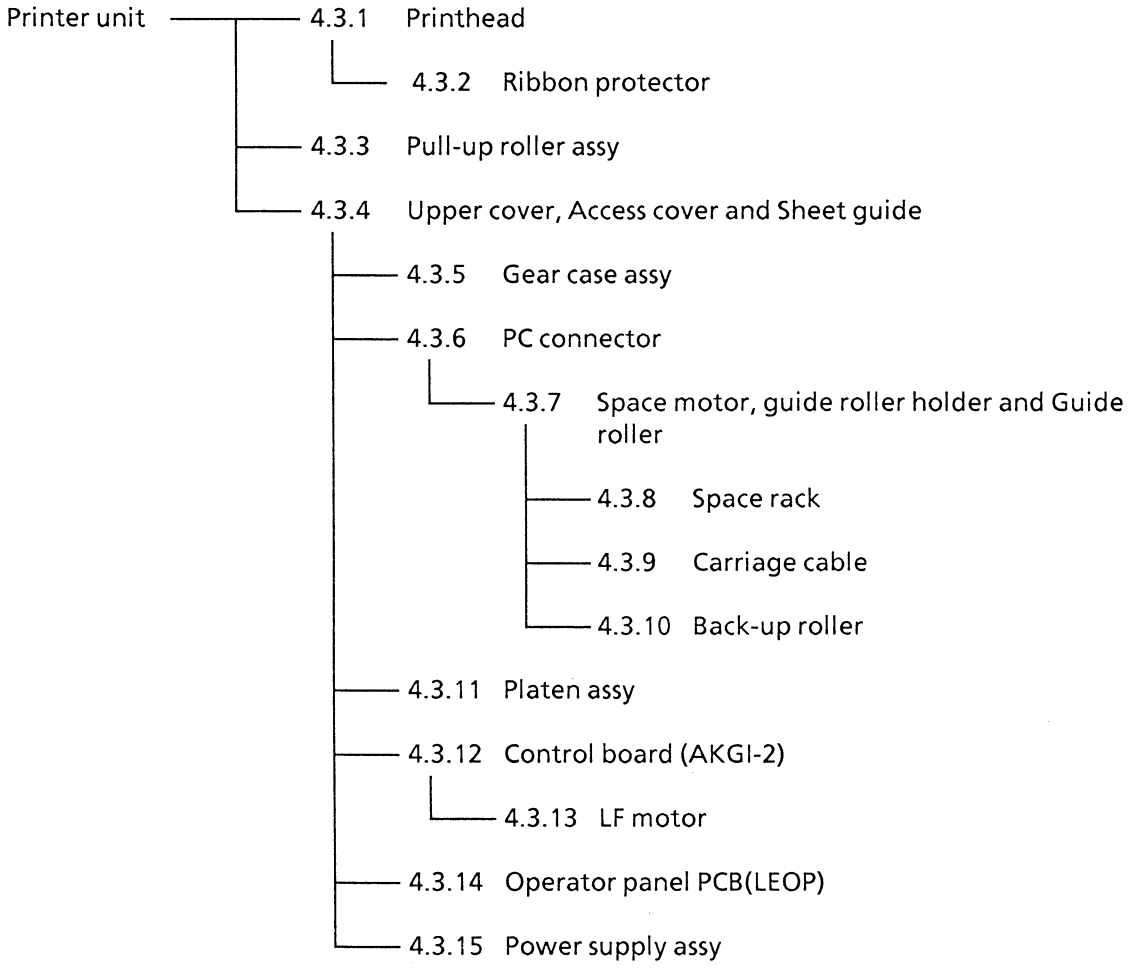


Figure 4-1 Printer unit

[How to Change Parts]

This section explains how to change parts and assemblies appearing in the disassembly diagram below.



4.3.1 Printhead

(1) Open the access cover.

(2) Pull up and rotate the head clamp ① to unclamp the printhead ② as shown fig. 4.3.1.

(3) Disconnect the printhead ② from PC connector ③.

(4) To install, follow the removal steps in the reverse order.

Notes on installation:

(1) Insert the printhead ② into the PC connector ③ while pushing it against the carriage frame ④.

(2) The head clamp ① must surely be sandwiched between printhead ② and carriage frame ④ as shown fig. 4.3.2.

(3) Be sure to check the gap between platen and printhead (See 5.1).

(4) Printhead self-adjust test is required when printhead is replaced in order to install the particular data of new printhead in the EEPROM on control board.

(5) Be careful not to touch the board because static electricity may damage the board when the printhead is not mounted.

(6) Be sure to disconnect or reconnect the printhead more than 10 seconds later since the power has been turned OFF.

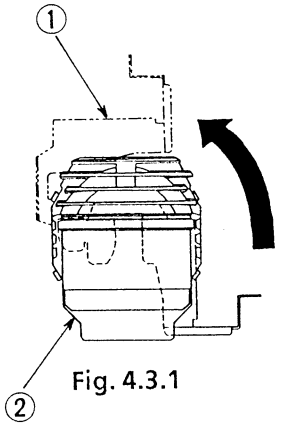


Fig. 4.3.1

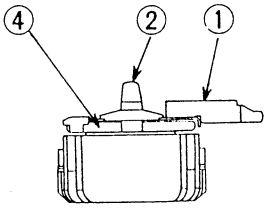
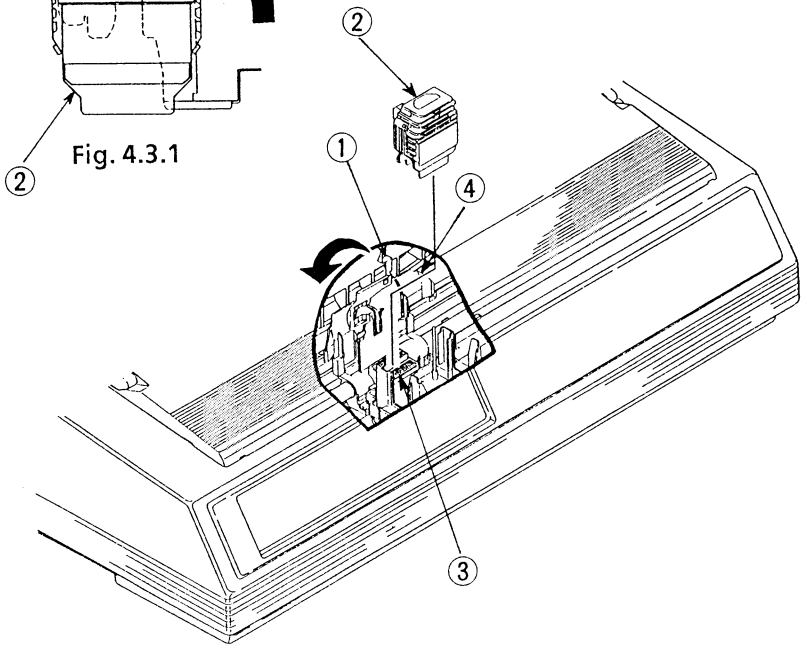


Fig. 4.3.2



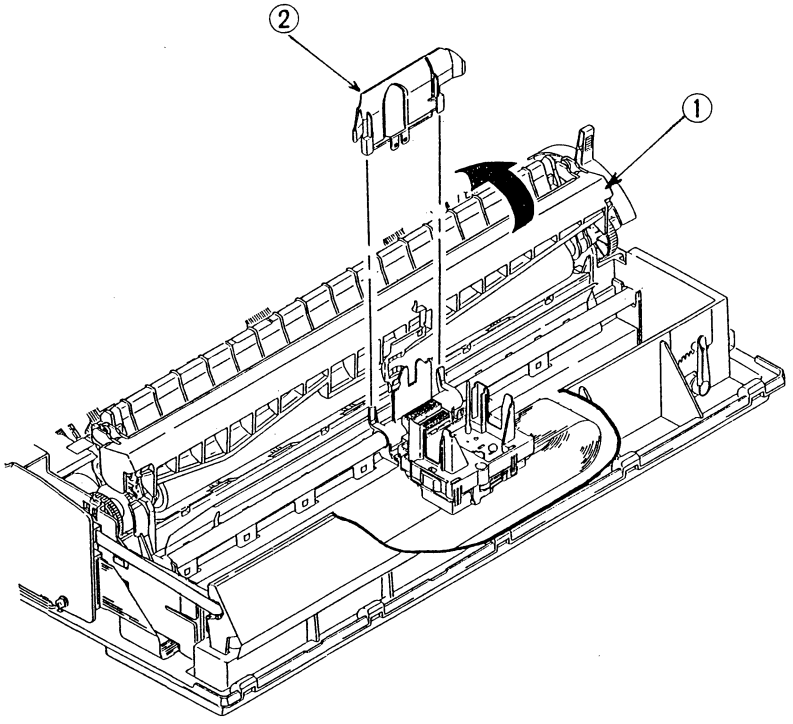
4.3.2 Ribbon Protector

(1) Remove the printhead (see 4.3.1).

(2) Open the pull-up roller cover ①.

(3) Raise and remove the ribbon protector ②.

(4) To install, follow the removal steps in the reverse order.

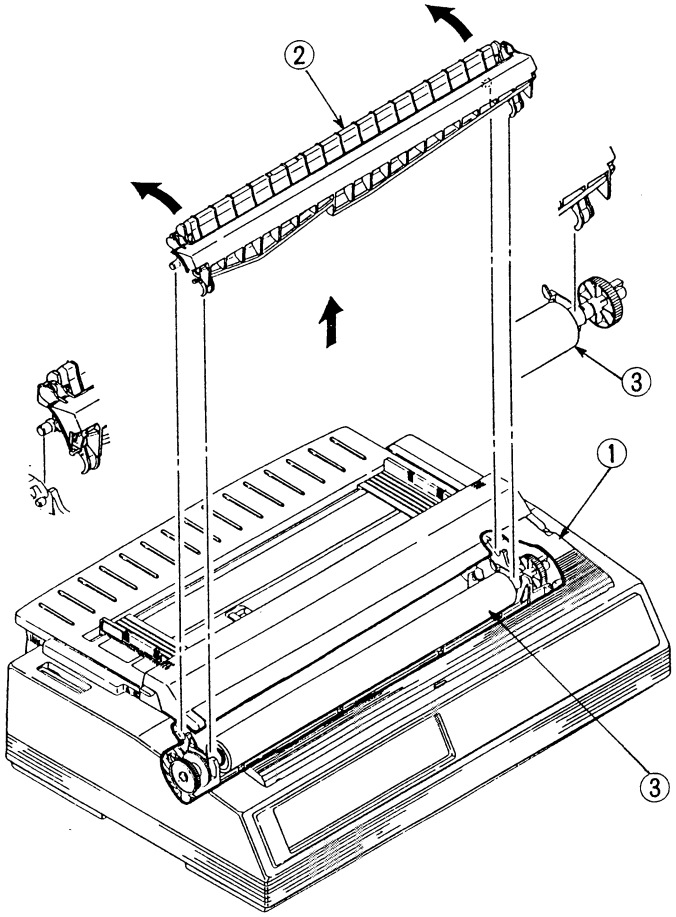


4.3.3 Pull-up Roller Assy

(1) Open the access cover ①.

(2) Tilting the pull-up roller Assy ② toward the rear, remove from shaft of platen Assy ③.

(3) To install, follow the removal steps in the reverse order.



4.3.4 Upper Cover Assy, Access Cover Assy and Sheet Guide Assy

(1) Pull off the platen knob ①.

(2) Turn the change lever ② toward the bottom position.

(3) Insert a flat-blade screwdriver into grooves (5 places) (4 places for 590) of frame and twist to disengage claws of upper cover ③.

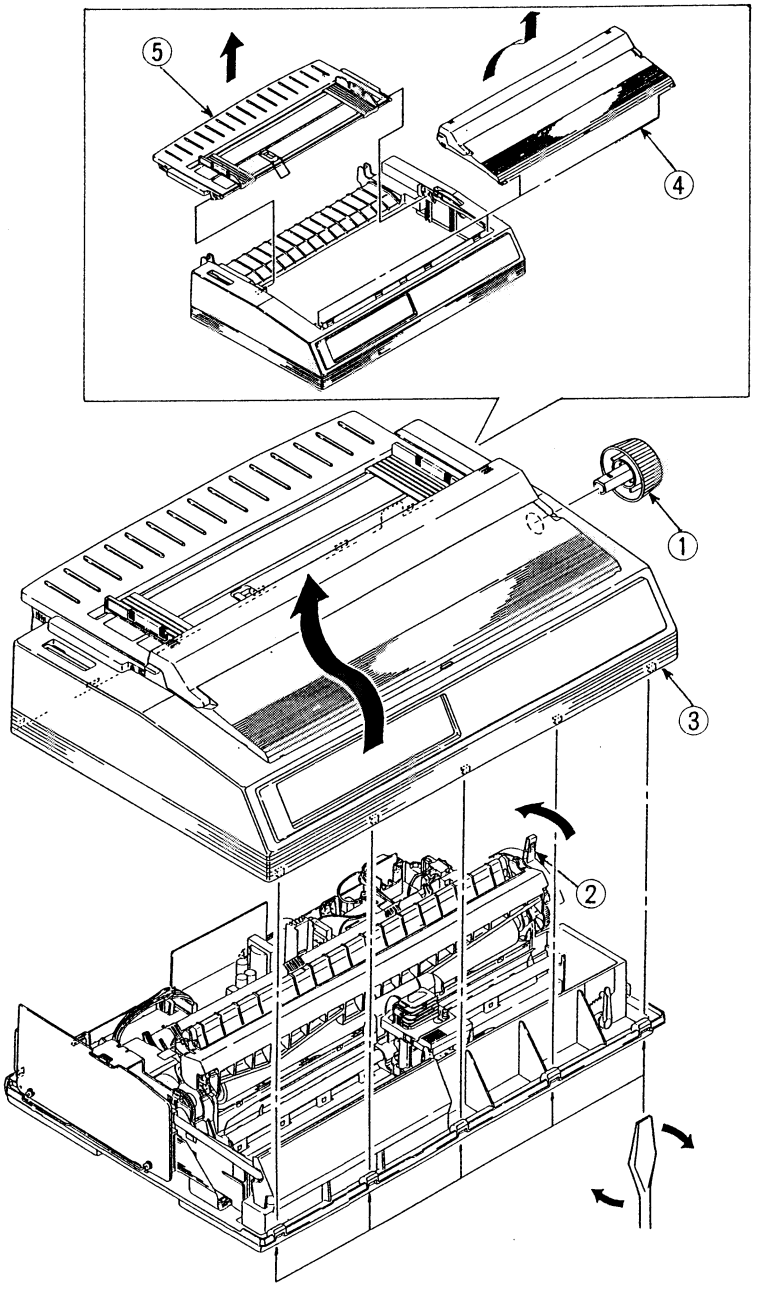
(4) Raise the front side of upper cover Assy ③ and shift toward the rear to disengage claws (6 places) (5 places for 590) of frame.

(5) Raise the upper cover Assy ③ to remove.

(6) Open the access cover Assy ④ toward the front to remove.

(7) Raise the sheet guide Assy ⑤ to remove.

(8) To install, follow the removal steps in the reverse order.



4.3.5 Gear Case Assy

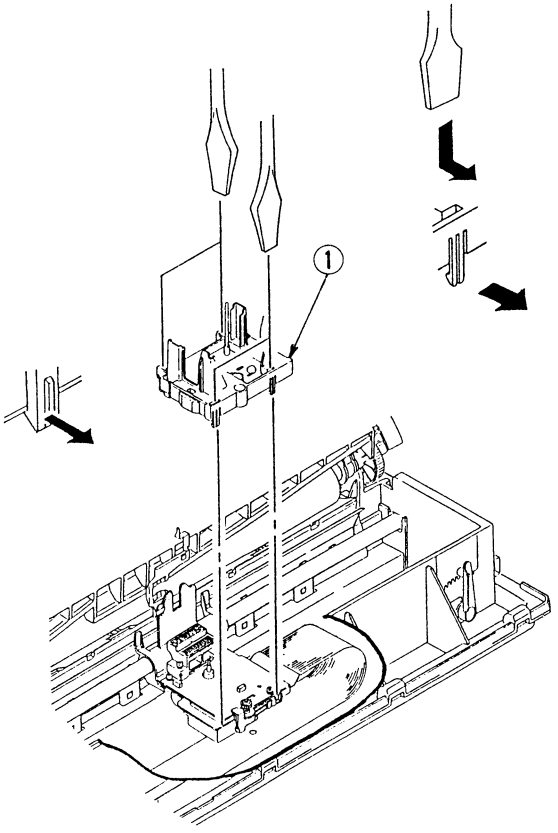
(1) Remove the upper cover (see 4.3.4).

(2) Disengage claws (4 places).
Using a flat-blade screwdriver, push to widen the claw for easy disengagement.

(3) Remove the gear case Assy ① in upper direction.

(4) To install, follow the removal steps in the reverse order.

(5) Be sure to check, and adjust if necessary, the gap between platen and printhead (see 5.1).



4.3.6 PC Connector

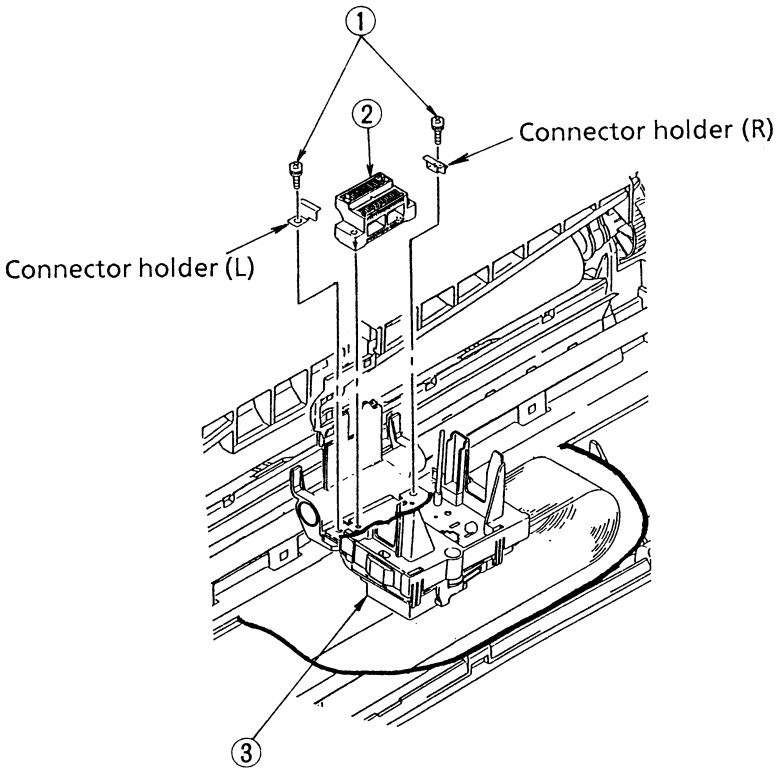
(1) Remove the printhead (see 4.3.1).

(2) Remove two screws ①, then the PC connector ②.
(At this time, connector holder (L) and (R) will be released.)

(3) To install, follow the removal steps in the reverse order.

Note on installation:

(1) Do not touch the space motor ③ or terminals of PC connector ②. Also, take care to avoid dust or foreign matters.



4.3.7 Space Motor, Guide Roller Assy

(1) Remove the printhead (see 4.3.1).

(2) Remove the upper cover (see 4.3.4 (1)-(5)).

(3) Remove the gear case Assy (see 4.3.5).

(4) Remove the PC connector (see 4.3.6).

(5) Remove two screws ①, then the space motor ②.

(6) Disconnect a cartridge cable ③.

(7) Remove screw ④, then the guide roller assy ⑤ from the space motor ②.

(8) To install, follow the removal steps in the reverse order.

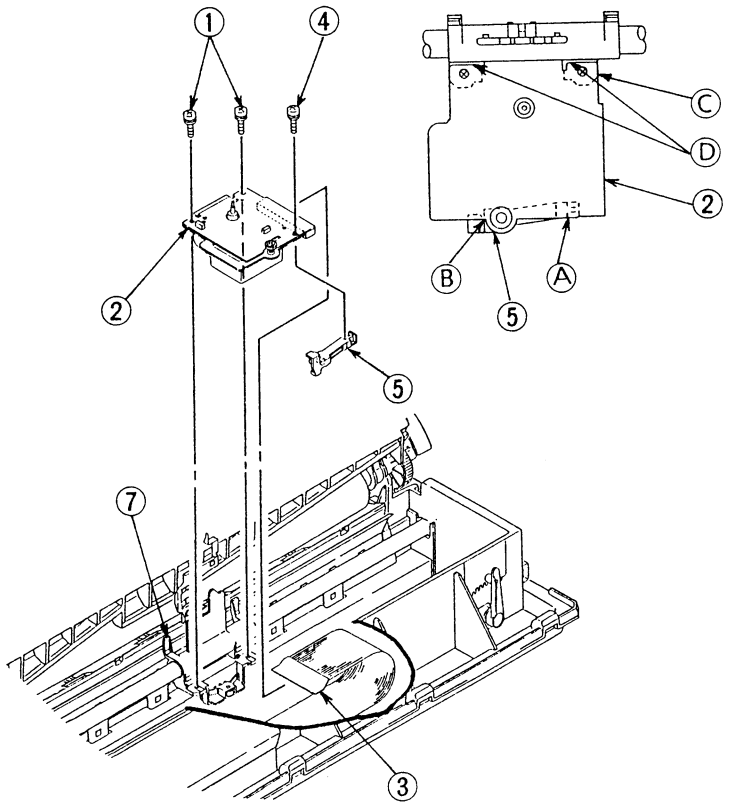
Notes on installation:

(1) Do not touch the terminals of space motor ②. Also, take care to avoid dust or foreign matters.

(2) When installing the guide roller assy ⑤, push portions A and B against the space motor ②.

(3) When installing the space motor ②, align the face C with carriage frame ⑦ and push portion D against the frame.

(4) After installation, check and adjust the gap between platen and printhead (see 5.1).



4.3.8 Space Rack

(1) Remove the printhead (see 4.3.1).

(2) Remove the upper cover (see 4.3.4 (1)-(5)).

(3) Remove the gear case Assy (see 4.3.5).

(4) Remove the space motor (see 4.3.7).

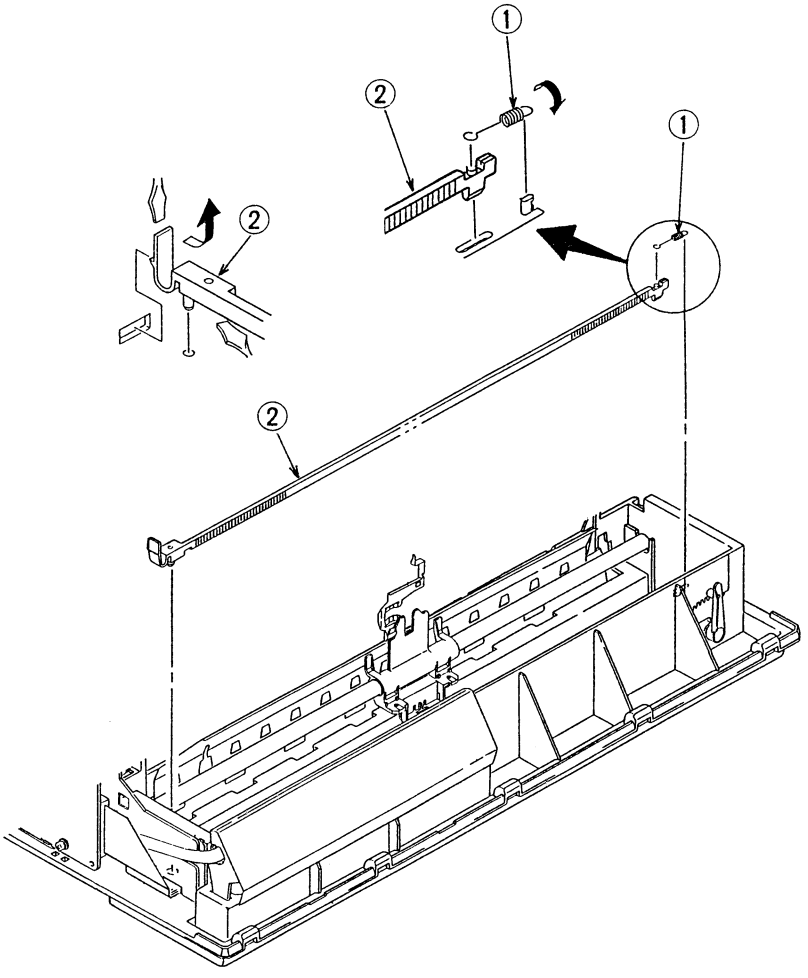
(5) Remove the spring ①.

(6) Disengage the claw on left side of space rack ② from the frame, and remove the space rack ② in upper direction.

(7) To install, follow the removal steps in the reverse order.

Notes on installation:

(1) After installation, check and adjust the gap between platen and printhead (see 5.1).



4.3.9 Carriage Cable

(1) Remove the printhead (see 4.3.1).

(2) Remove the upper cover (see 4.3.4 (1)-(5)).

(3) Remove the gear case Assy (see 4.3.5).

(4) Remove the space motor (see 4.3.7).

(5) Remove the space rack (see 4.3.8).

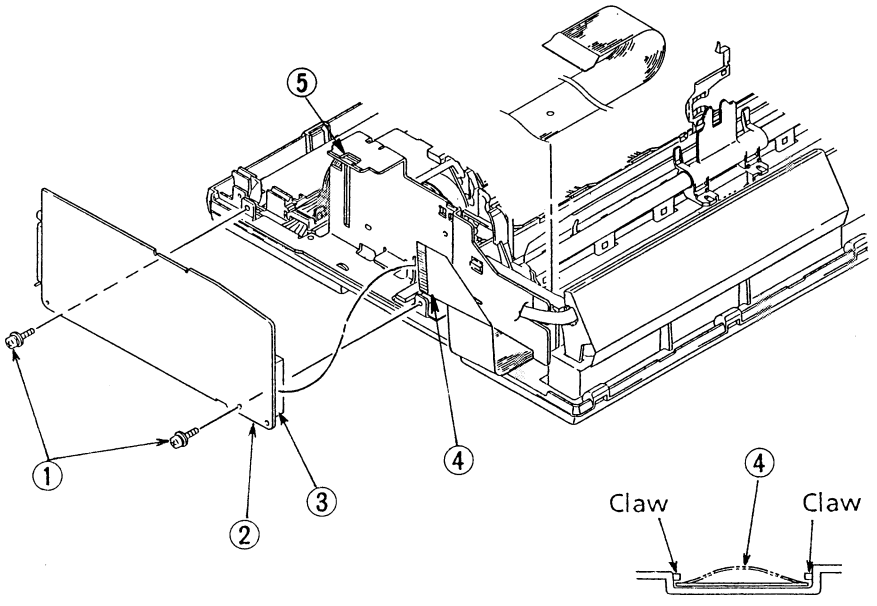
(6) Remove two screws ①, release the control board ② by lifting clamp ⑤, and disconnect carriage cable ④ from connector ③.

(7) Remove carriage cable ④ from fasteners on frame.

(8) To install, follow the removal steps in the reverse order.

Note on installation:

(1) Take care not to fold the carriage cable ④ during installation. Curve slightly the carriage cable ④ when assembling into the fasteners.



4.3.10 Backup Roller

(1) Remove the printhead (see 4.3.1).

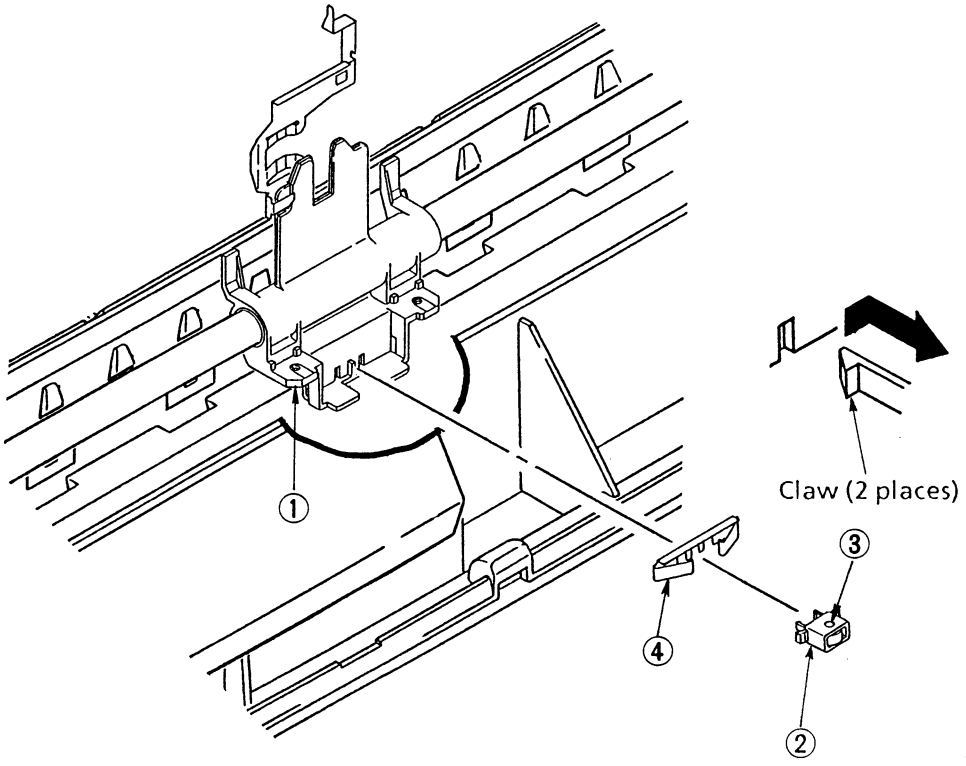
(2) Remove the upper cover (see 4.3.4 (1)-(5)).

(3) Remove the gear case Assy (see 4.3.5).

(4) Remove the space motor (see 4.3.7).

(5) Disengage claws (2 places) of roller holder from the carriage frame ①, and remove the backup roller ② and the backup roller spring ④.

(6) To install, follow the removal steps in the reverse order.



Note: Small round hole with metal tip ③ on back up roller should be facing up when installing.

4.3.11 Platen Assy

(1) Remove the printhead (see 4.3.1).

(2) Remove the ribbon protector (see 4.3.2).

(3) Remove the pull-up roller Assy (see 4.3.3).

(4) Remove the upper cover (see 4.3.4 (1)-(5)).

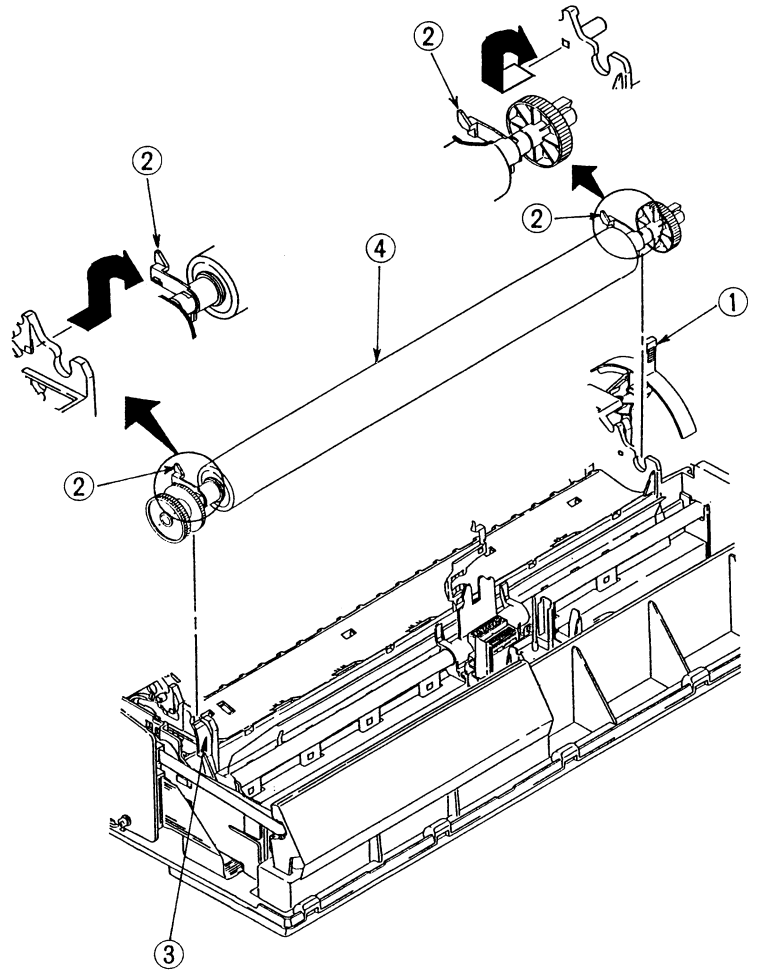
(5) Turn the change lever ① to the bottom position.

(6) Push in the lock levers ② on both sides to unlock from the frame, then rotate them upward by 90°.

(7) Meeting the support protector ③ with the position of lock lever ② on left side, remove the platen Assy ④ from the left side of the frame.

(8) Remove the platen Assy ④ from the right side of the frame.

(9) To install, follow the removal steps in the reverse order.



4.3.12 Control Board (AKGI-2)

(1) Remove the upper cover (see 4.3.4 (1)-(5)).

(2) Remove two screws ①, and release the control board ② by lifting clamp ④.

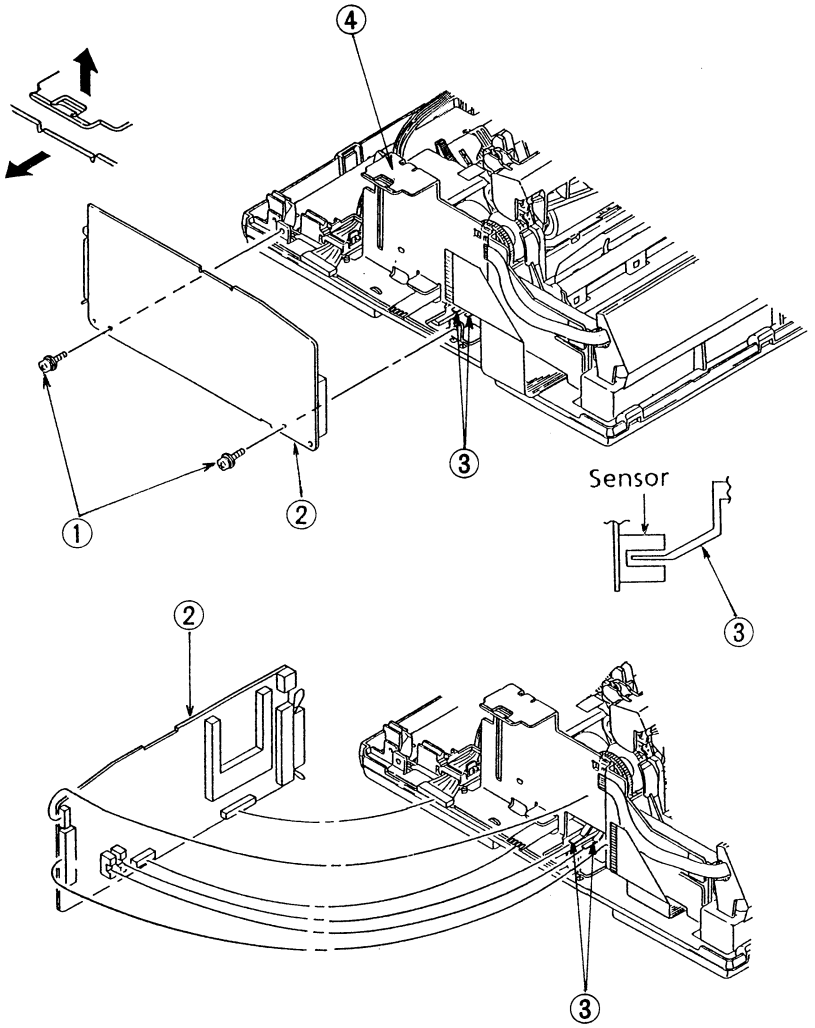
(3) Disconnect all cables from control board ②.

(4) To install, follow the removal steps in the reverse order.

Note on installation:

(1) Insert two sensor levers ③ between sensors when installing the control board ②.

(2) Printhead self-adjust test is required when the control board is replaced in order to install the particular data of printhead in the EEPROM on the control board (see 5.2).



4.3.13 LF Motor

(1) Remove the printhead (see 4.3.1).

(2) Remove the ribbon protector (see 4.3.2).

(3) Remove the pull-up roller Assy (see 4.3.3).

(4) Remove the upper cover (see 4.3.4 (1)-(5)).

(5) Remove the platen Assy (see 4.3.11).

(6) Remove the control board (see 4.3.12).

(7) Remove the left FG plate ①.

(8) Remove the rear pressure roller ②.

(9) Remove the lock spring ⑥.

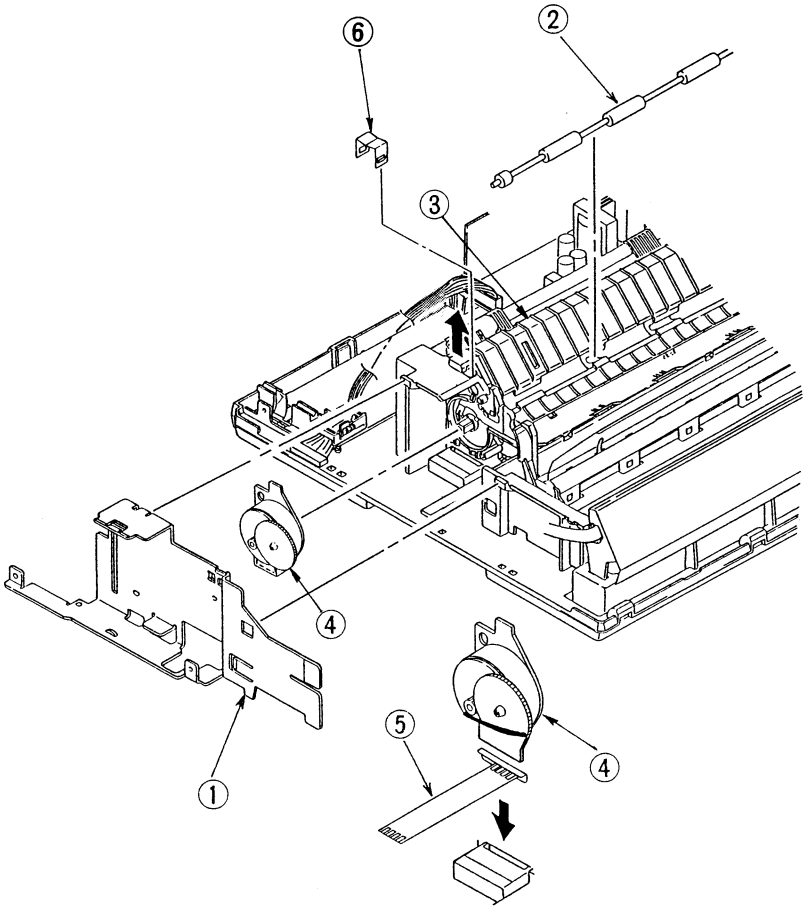
(10) Raise the left side of paper chute Assy ③ by about 5mm.

(11) Remove the LF motor ④.

(12) To install, follow the removal steps in the reverse order.

Note on installation:

(1) Be sure to insert LF cord ⑤ under the LF motor ④.



4.3.14 Operator Panel PCB (LEOP)

(1) Remove the upper cover (see 4.3.4 (1)-(5)).

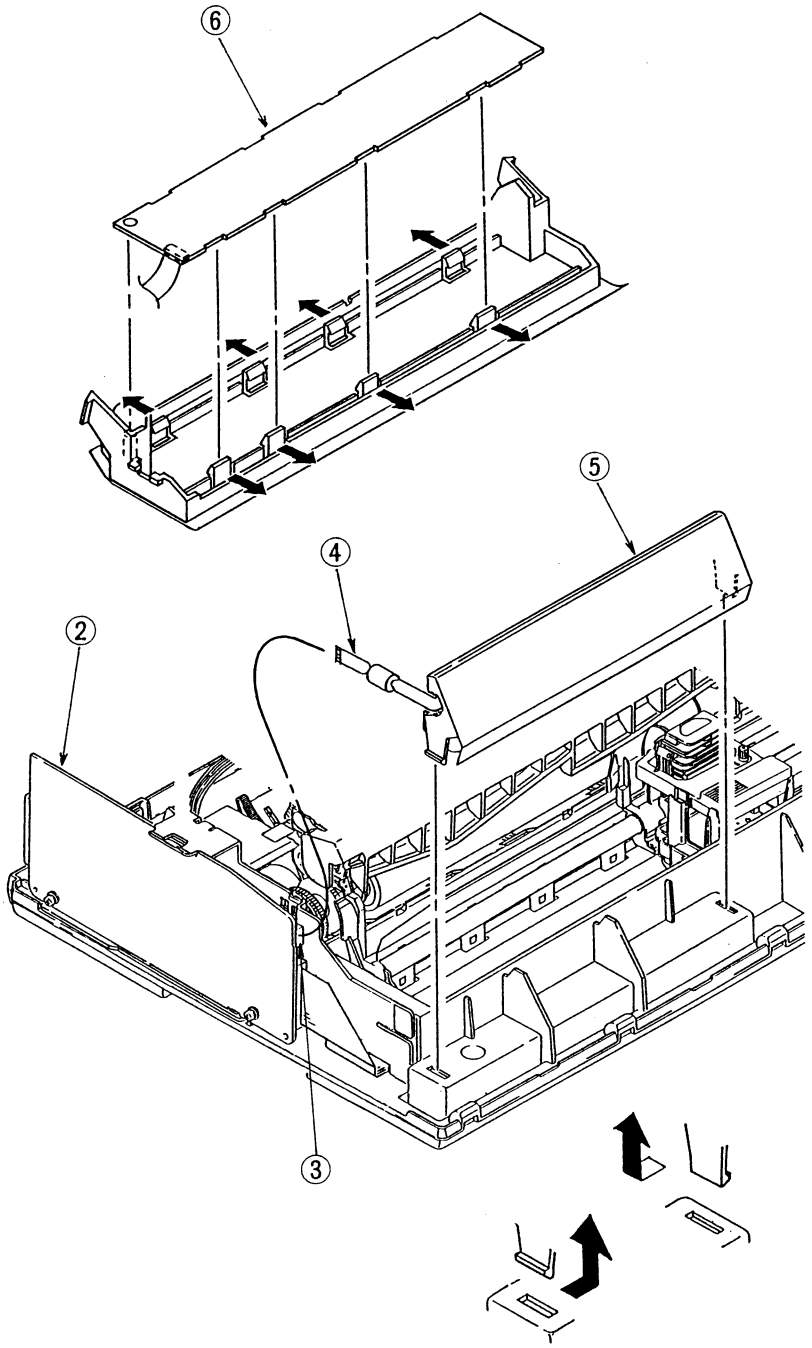
(2) Cut off tie-wrap for attaching cora.

(3) Disconnect the cable ④ from connector ③ of control board ②.

(4) Disengage claws on both sides from the frame, and remove the operator panel ⑤ in upper direction.

(5) Open claws (8 places) and remove the operator panel PCB ⑥ from the operator panel ⑤.

(6) To install, follow the removal steps in the reverse order.



4.3.15 Power Supply Assy

(1) Remove the upper cover (see 4.3.4 (1)-(5)).

(2) Remove the code clamp ⑩.

(3) Disconnect the cable ③ from the connector ② on control board.

(4) Remove the code cover ⑪.

(5) Remove AC inlet ④ and AC switch ⑤ from the frame guide.

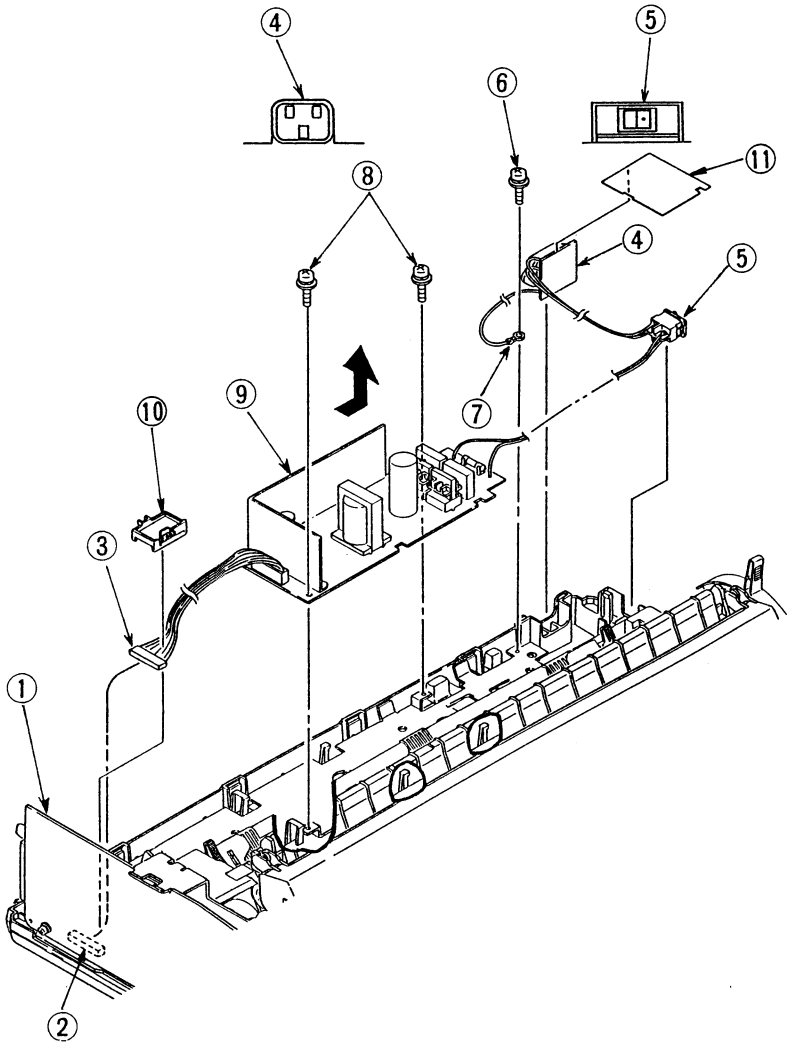
(6) Remove a screw ⑥ and disconnect ground cable ⑦.

(7) Remove two screws ⑧, and shift the power supply board ⑨ to disengage from claws (4 places).

(8) To install, follow the removal steps in the reverse order.

Note on installation:

(1) Take care when installing the AC inlet ④ and AC switch ⑤ for correct orientation.



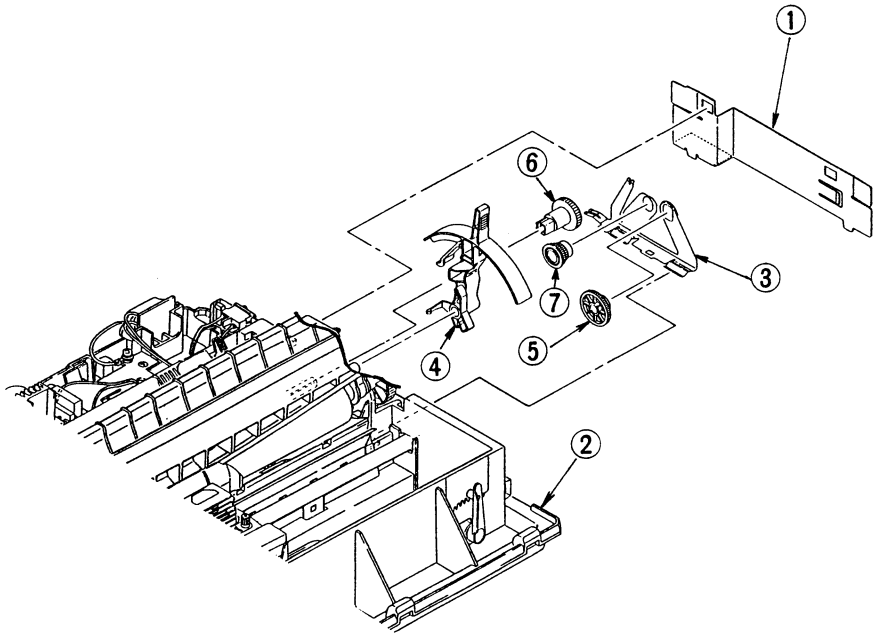
4.3.16 Change Lever and Gears

(1) Remove the upper cover (see 4.3.4 (1)-(5)).

(2) Detach the FG plate (R) ① from the pawls of the main frame.

(3) Remove the reset spring ③, then remove the change lever ④, the idle gear ⑤, the tractor gear ⑥ and the change gear ⑦.

(4) To perform mounting, follow the reverse procedure of removal.



4.3.17 Carriage Shaft and Support Protector

(1) Remove the printhead (see 4.3.1).

(2) Remove the upper cover (see 4.3.4 (1)-(5)).

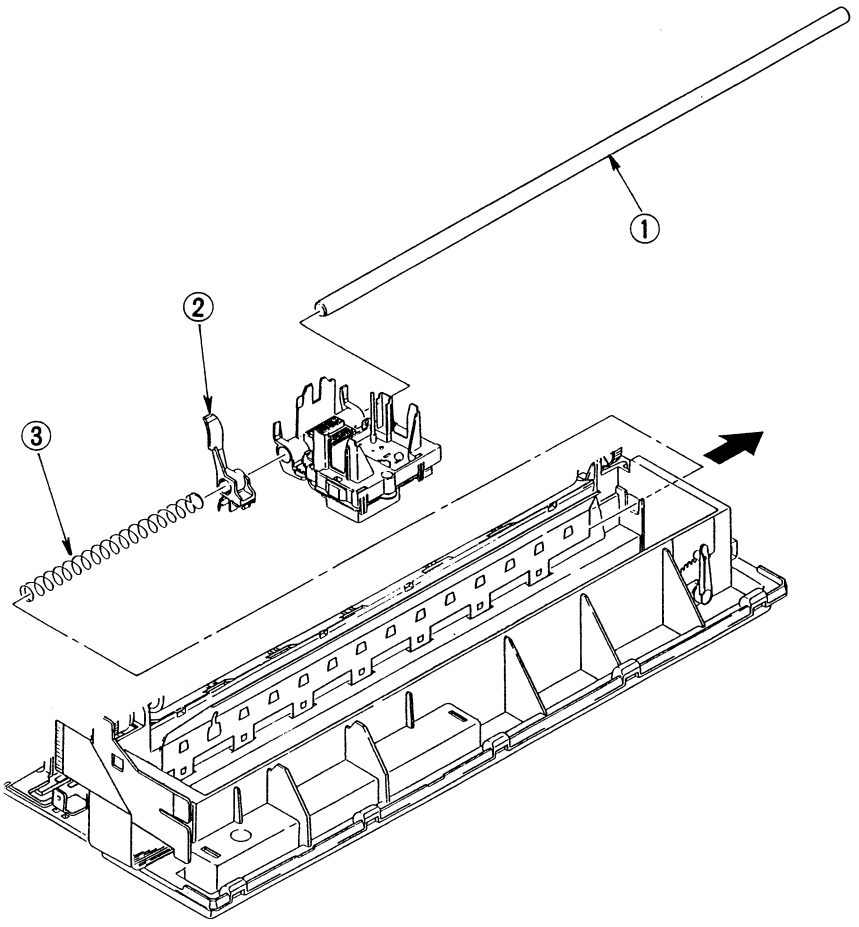
(3) Remove the FG plate (R) (see 4.3.16 (2)).

(4) Slide the carriage shaft ① to the right side (in the direction of the arrow) to remove. (The support protector ② and the support protector reset spring ③ will be detached at the same time).

(5) To perform mounting, follow the reverse procedure of removal.

Note on installation:

(1) After installation, check and adjust the gap between platen and printhead (see 5.1).



4.3.18 Paper Chute Assy

(1) Remove the printhead (see 4.3.1).

(2) Remove the ribbon protector (see 4.3.2).

(3) Remove the pull-up roller assy (see 4.3.3).

(4) Remove the upper cover assy (see 4.3.4 (1)-(5)).

(5) Remove the platen assy (see 4.3.11).

(6) Remove the control board (see 4.3.12).

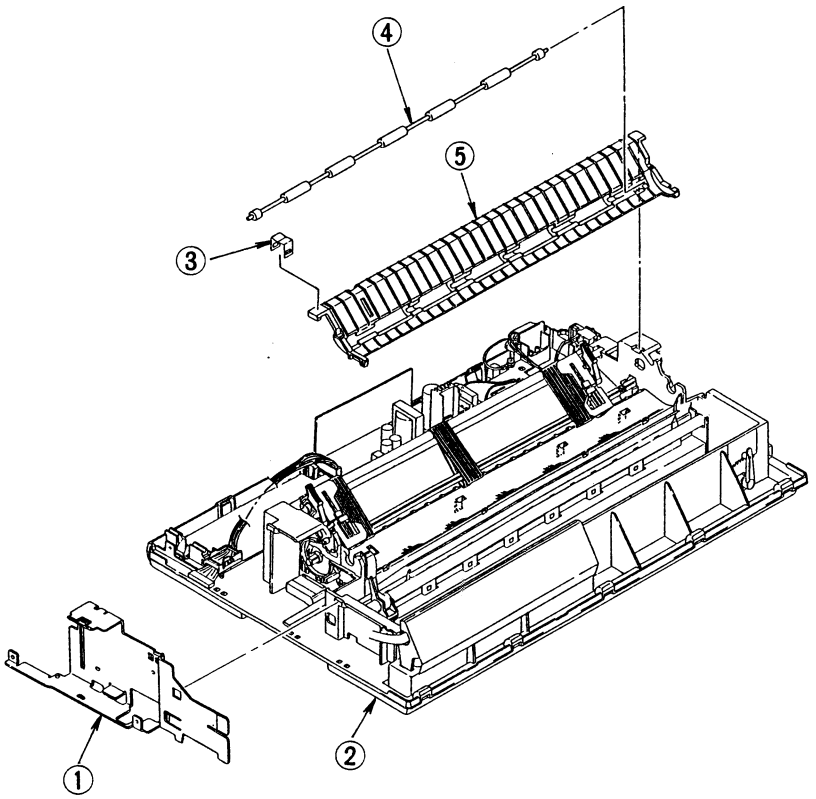
(7) Detach the FG plate (L) assy ① from the pawls of the main frame ②.

(8) Remove the lock spring ③.

(9) Remove the rear pressure roller ④.

(10) Lift up the paper chute assy ⑤ and remove.

(11) To perform mounting, follow the reverse procedure of removal.



4.3.19 Rear Tractor Assy

(1) Remove the printhead (see 4.3.1).

(2) Remove the ribbon protector (see 4.3.2).

(3) Remove the pull-up roller assy (see 4.3.3).

(4) Remove the upper cover (see 4.3.4 (1)-(5)).

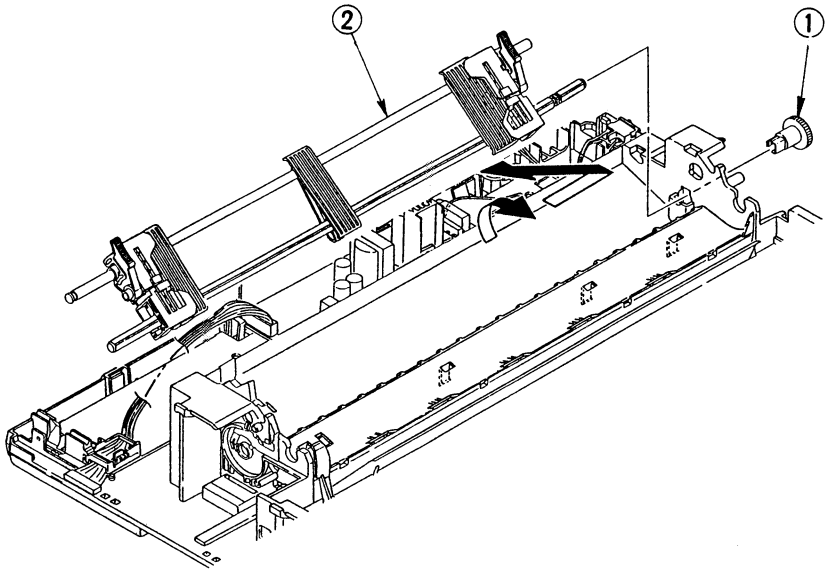
(5) Remove the FG plate (R) (see 4.3.16 (2)).

(6) Remove the reset spring (see 4.3.16 (3)).

(7) Remove the tractor gear ①.

(8) Lift up the rear tractor assy ② to your side (in the direction of the arrow), then push it to the right side and lift up the left end of it to remove (in the direction of the arrow).

(9) To perform mounting, follow the reverse procedure of removal.



4.3.20 Rear Pressure SP Assy

(1) Remove the upper cover (see 4.3.4 (1)-(5)).

(2) Remove the change lever and gears (see 4.3.16).

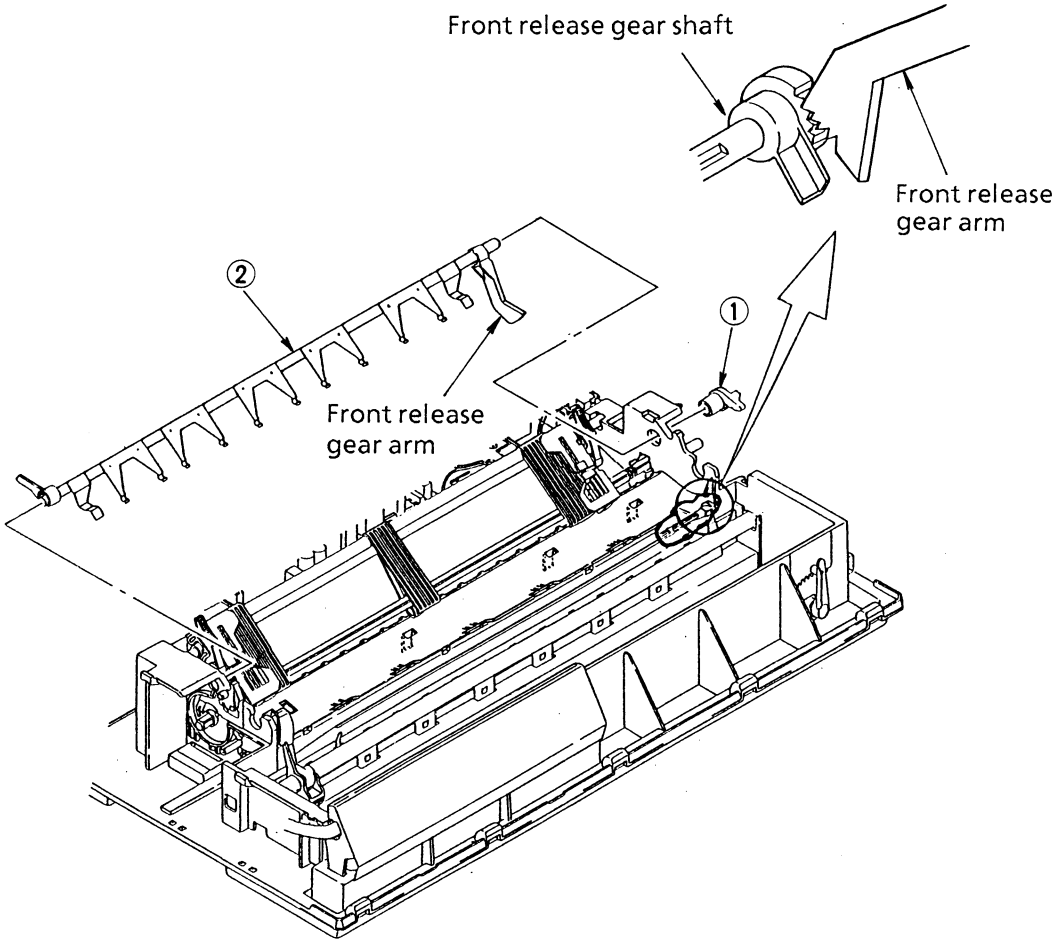
(3) Remove the paper chute assy (see 4.3.18).

(4) Release cum ①.

(5) Remove rear pressure SP assy ②.

(6) To install, follow the removal step in the reverse order.

Note) At mounting rear pressure SP assy, pay attention to the gear engagement of front release gear shaft. (Engage with one tooth shifted)



5. ADJUSTMENT

5. ADJUSTMENT

(1) Be sure to carry out this adjustment with the printer mechanism mounted on the lower cover.

(2) Be sure to carry out this adjustment operation on a level and highly rigid work table (flatness: less than 0.039 inch or 1 mm) so as to minimize adjustment error.

5.1 Gap Between Platen and Printhead

(1) Adjusting position

Perform adjustment at the three positions of left, center and right ends of the platen.

(2) Adjustment value

a=0.014±0.002 inch (0.35±0.05mm)

(3) Adjustment procedure

(a) Remove ribbon cartridge.

(b) Turn the change lever to the Rear position.

(c) Rotating the platen, position the claw of platen gear on the top.

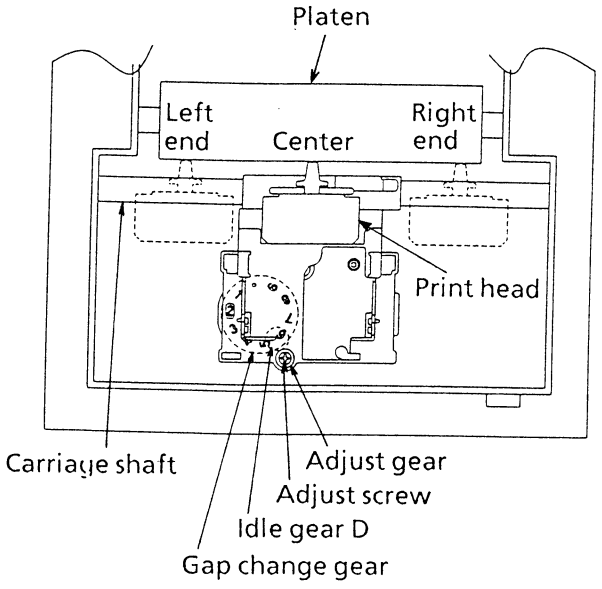
(d) Set the gap change gear to range 2.

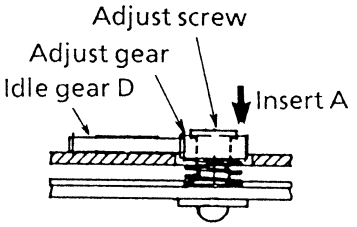
(e) If gap is different between left and right sides of platen, adjust by rotating the adjust cam to the left or right.

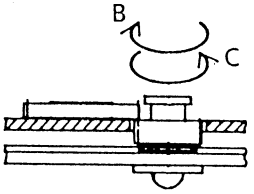
(f) When gap adjustment is necessary, push the adjust gear downward (in direction A) with head gap adjustment tool to disengage adjust gear from idle gear D. Under this condition, rotate the adjust screw in direction B or C.

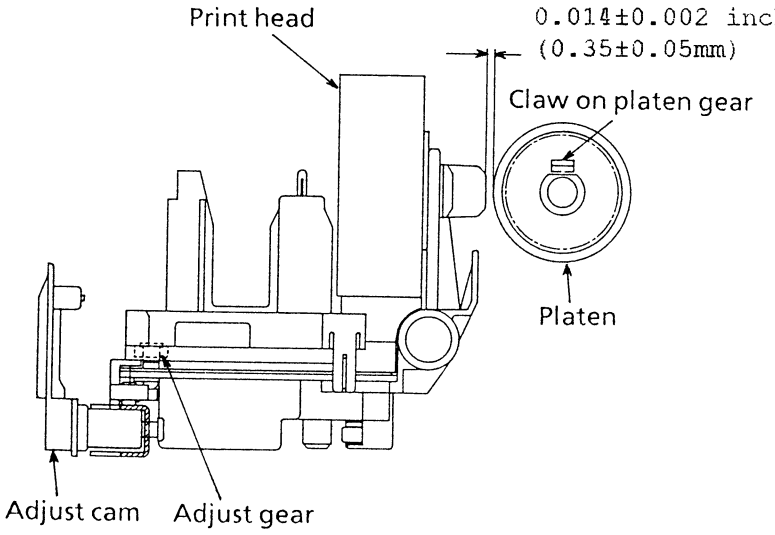
(g) After adjustment, mark the adjust cam position with a red pen.

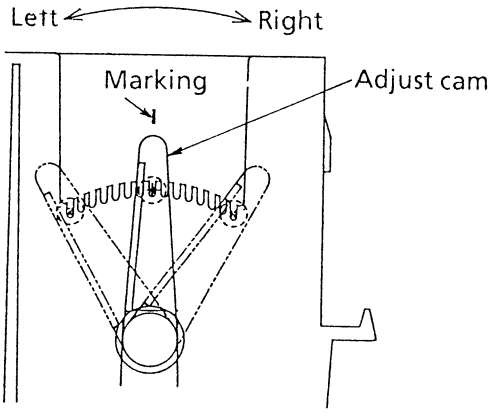
Note 1: When checking the printhead gap, lift and pull back the ribbon protector to move it out of the way to insure proper gap setting.


Platen
Left end
Center
Right end
Print head
Carriage shaft
Adjust gear
Adjust screw
Idle gear D
Gap change gear


Adjust screw
Adjust gear
Idle gear D
Insert A


B
C


Print head
0.014±0.002 inch
(0.35±0.05mm)
Claw on platen gear
Platen
Adjust cam
Adjust gear


Left
Right
Marking
Adjust cam

5.2 Printhead Self-Adjust Test

Perform the following operation, if the printhead, main controller board or EEPROM is replaced or if auto gap is disabled.

(1) Make the paper end condition and the ribbon cassette mounted condition.

(2) Turn ON the power switch while pressing the "TEAR" + "QUIET" keys.

(3) The self-adjust will be performed automatically.

(4) If no alarm is indicated, test is completed successfully.

If alarm is indicated (See Table 7.3):

In this case, try again after adjusting the head (See 5.1) gap or replacing the printhead.

- Printhead gap 2 alarm →
- Head gap must be too wide or too narrow.
- Printhead gap 1 alarm →
- There must be some abnormal pin.

* The above-mentioned alarm may be sound due to a printhead which has been used many times. However, the head is to be regarded as good if the gap range and print quality are normal under the following test procedure:

(1) Make the paper-end condition and set the ribbon cassette.

(2) Turn on the power switch without pressing any key.

(3) The self-adjust will be performed automatically.
(In this mode, the above mentioned.)

(4) Load a single paper, then make a test print.

(5) Be sure the head gap step is set to 2 or 3.

6. CLEANING AND LUBRICATION

6. CLEANING AND LUBRICATION

6.1 CLEANING

[Cautions]

1. Be sure to turn OFF the AC POWER switch before cleaning.

2. Avoid dust inside the printer mechanism when cleaning.

3. If a lubricated part has been cleaned, be sure to apply lubricating oil to that portion after cleaning.

   (1) **Cleaning time**

   When the equipment operating time has reached six months or 300 hours, whichever comes first.

   (2) **Cleaning tools**

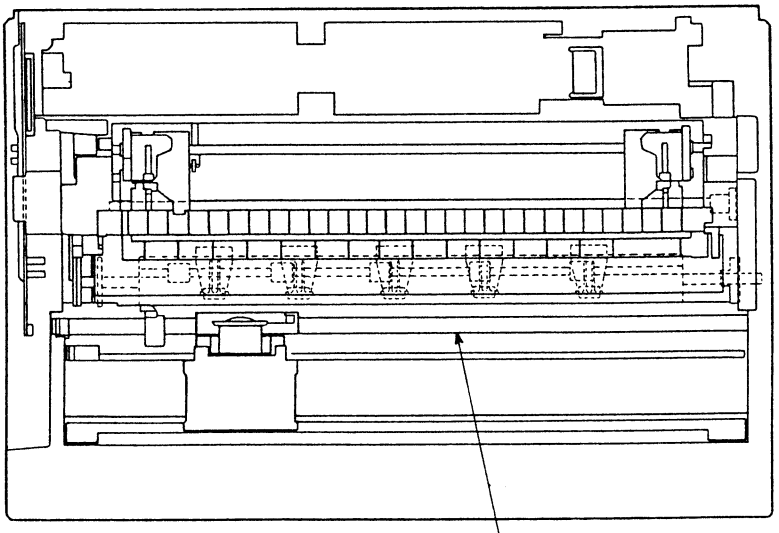
   Dry cloth (soft cloth such as gauze), vacuum cleaner

   (3) **Places to be cleaned**

   Table 6.1 lists the places to be cleaned:

Table 6.1

Place to be cleaned	Cleaning procedure
Carriage shaft and the vicinity Paper travel surface	Remove paper waste and wipe off stain, dust, ribbon waste. etc.


Carriage shaft

6.2 LUBRICATION

(1) Cleaning time

When the operating hours have reached one year or 600 hours.

(2) Lubricant

- Pan motor oil 10W-30 (or equivalent):PM
- Alvania grease #2EP (or equivalent): GEP

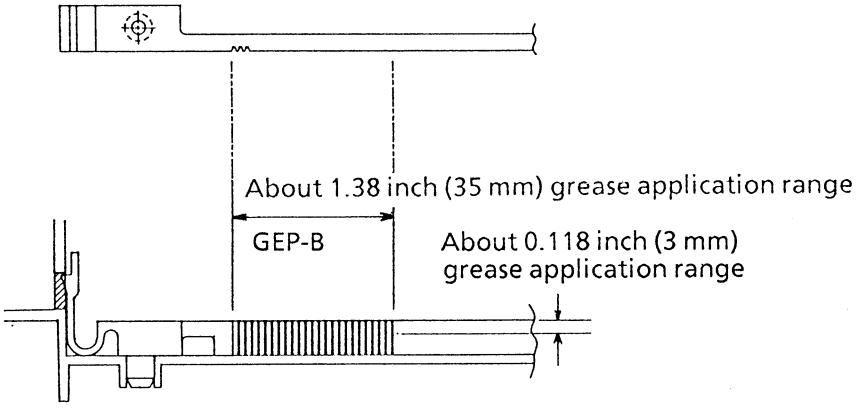
(3) Amount of lubricant

- Medium amount A : Apply three to four drops of oil, or 0.008 inch (0.2 mm) thick grease.
- Small amount B : Apply one drop of oil.

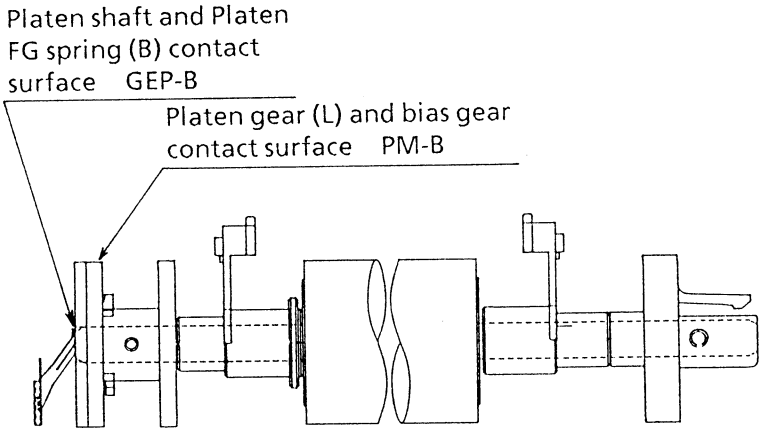
(4) Areas to Avoid

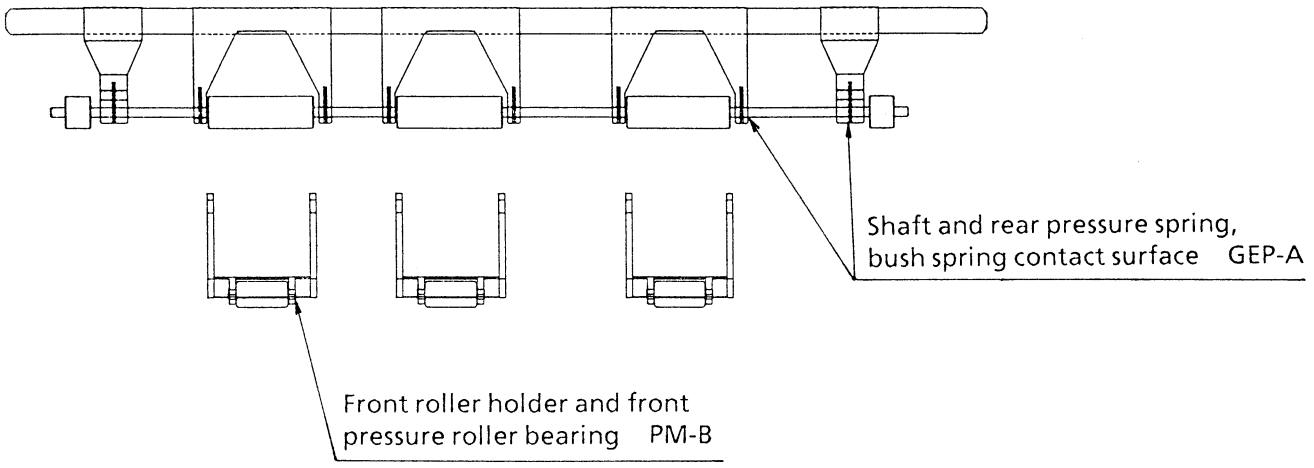
No.	Do not lubricate	Reason	Remarks
1	Ink ribbon	To prevent blurring of print image	
2	Platen assembly (rubber face)	To prevent stained paper	
3	Pressure roller (rubber face)	To prevent stained paper	
4	Pin tractor	To prevent stained paper	
5	Carriage shaft	To stabilize carriage traveling load	
6	Flexible cable	To prevent loose connection and crack	
7	Space motor PCB	To prevent loose connection	
8	Connector terminals	To prevent loose connection	

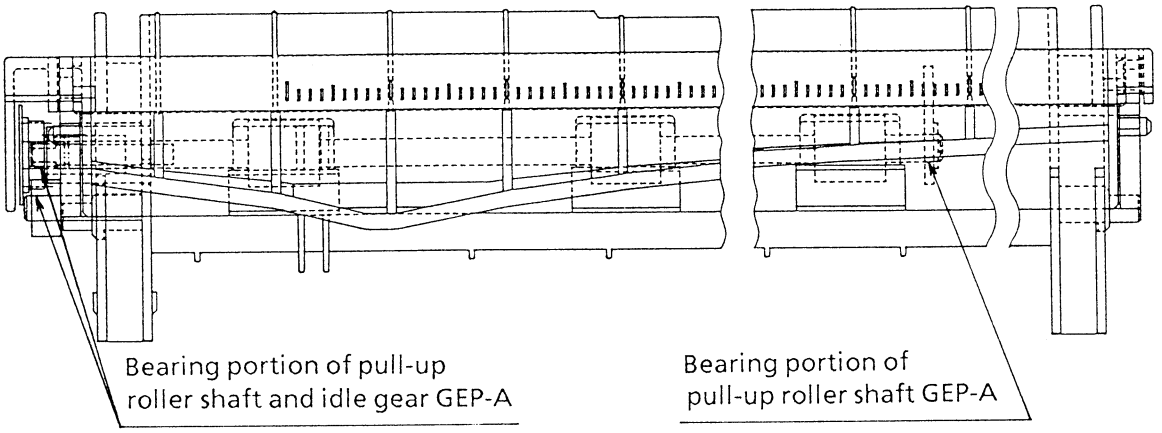
(5) Lubrication points



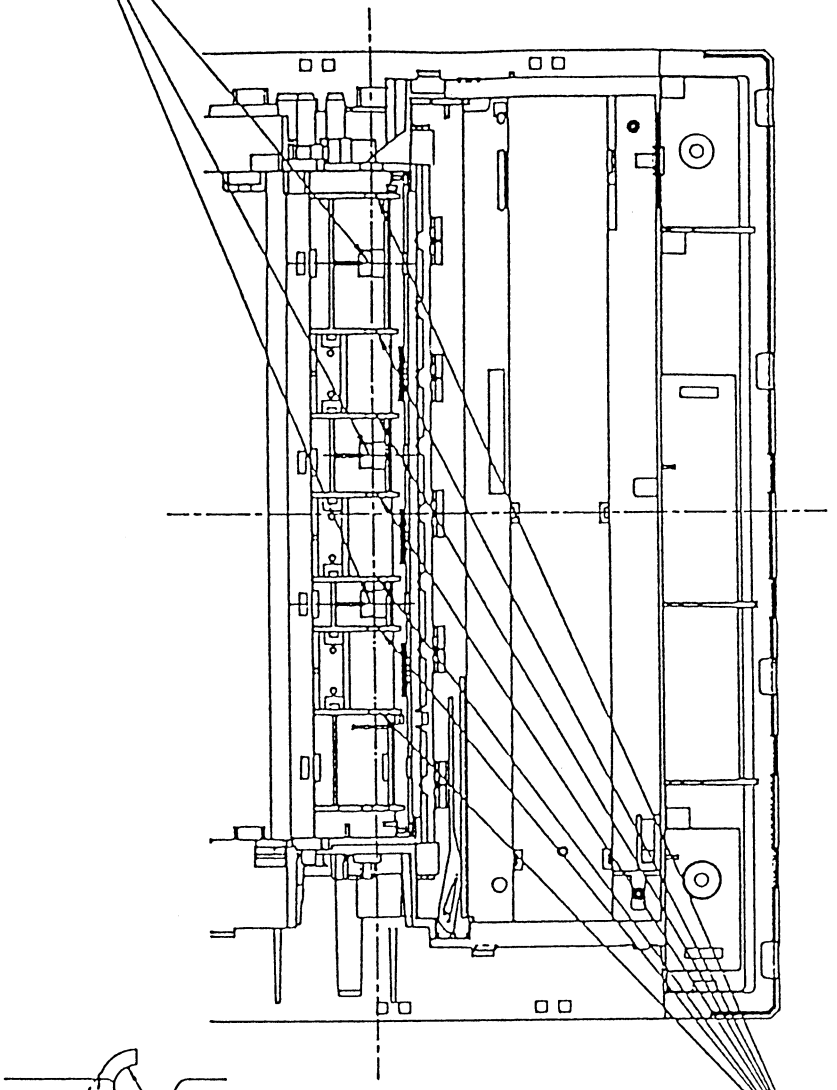
Caution: Use only a very small amount of grease on space rack to prevent accumulation of dirt.

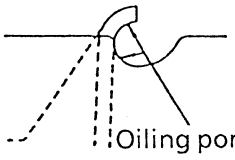



Shaft and rear pressure spring,
bush spring contact surface GEP-A
Front roller holder and front
pressure roller bearing PM-B


Bearing portion of pull-up
roller shaft and idle gear GEP-A
Bearing portion of
pull-up roller shaft GEP-A

Oiling portions (590: 3 places, 591: 5 places)
Apply proper quantity of Alvania grease on the rear side.
(GEP-A)





Rib Oiling portions (590: 3 places, 591: 5 places)
Apply proper quantity of Alvania grease on the rear side.
(GEP-A)

7. TROUBLESHOOTING AND REPAIR

7. TROUBLESHOOTING AND REPAIR

7.1 Items to Check Before Repair

(1) Check the inspection items specified in the instruction manual.

(2) Find out as many details of the trouble as possible from the customer.

(3) Inspect in the conditions as close as possible to those at the time the trouble occurred.

(4) Proceed with the repair as follows:

Check the trouble status according to Table 7.1 for the details of the trouble. Then, locate the trouble position according to the detailed flowchart.

(5) Carry out a thorough test after the repair to check for correct functioning.

7.2 Troubleshooting Table

Table 7.1

status	Trouble contents	Troubleshooting flowchart No.	Surmise of trouble
Trouble upon power on	• Power is not supplied	①	Power Supply unit, Control Board Operation Panel. Space motor, carriage Cable, Print Head.
	• No spacing operation	②	
	• Homing does not end normally	③	Space Motor, Carriage Cable Control Board, Spacing Mechanism
Trouble during printing	• Paper jam while paper insertion	④	Pressure roller Mechanism, Support Protector, Pull up roller cover.
	• Smearing/Missing dots	⑤	Print Head, Control Board, Space Motor, Carriage Cable
	• Faint or dark print	⑥	Print Head, Ribbon feed assembly, Control Board
	• Ribbon feed trouble	⑦	Ribbon feed assembly, Space motor, Control Board
	• Line feed trouble	⑧	LF motor, Platen assy, LF mechanism, Control Board
	• Malfunction of switch on operation panel.	⑨	Operation Panel, Control Board
	• Data receiving failure	⑩	Control Board, (I/F board), I/F Cable, Menu setting

7.3 Lamp Display

(1) Printer mode display

Table 7.2

ALARM CATEGORY	ALARM	LED CONDITION					CONTENTS	TROUBLE SHOOTING
		ALARM	SEL	MENU	10CPI	15CPI		
OPERATOR ALARM	Paper end alarm	ON	–	–	–	–	From, cut sheet or bottom paper end	Set New paper.
	Paper change lever alarm	ON	OFF	–	BLINK 1	OFF	Change lever is set to TOP position while paper is already inserted from rear or bottom.	• Set the lever to specified position. • Check rear sensor lever. • Replace Control Board
	Paper jam alarm	ON	OFF	–	OFF	BLINK 1	• Cut sheet could not be ejected. • Cut sheet could not be fed properly	• Remove the paper or check feed Mechanism • Press SEL key.
	Print Head thermal alarm	OFF	–	BLINK 1	–	–	Print head temperature exceeds 123°C.	• Wait until it is cooled. • Replace P.H. or Control Board
	Space motor thermal alarm	OFF	–	BLINK 1	–	–	Temperature of space motor exceeds specified value.	• It is recovered automatically. • Replace SP motor or Control Board
FATAL ALARM		BLINK 2	OFF	OFF	See Table 7.3		Hardware Alarm has occurred.	See Table 7.3.

Note:

BLINK1 : 400ms ON, 400ms OFF

BLINK2 : 200ms ON, 200ms OFF

– : LED is kept in Current Condition (no change)

(2) Fault alarm display

When the printer detects any of the various alarm states, the information is displayed as shown below on the operation panel. The alarm is specified by lamp combination of PRINT QUALITY and CHARACTER PITCH. (See Table 7.3 for details.)

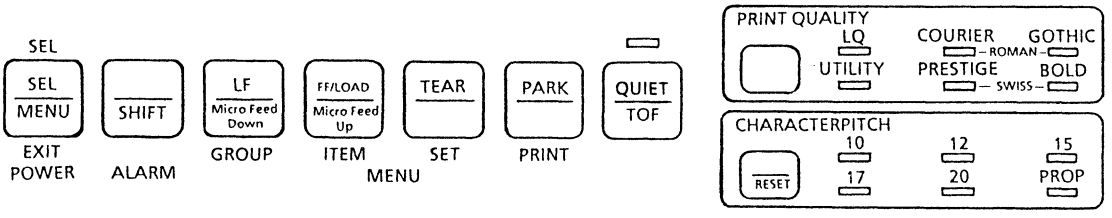


Figure 7-1

(3) Fatal Alarm

Table 7.3 (1/2)

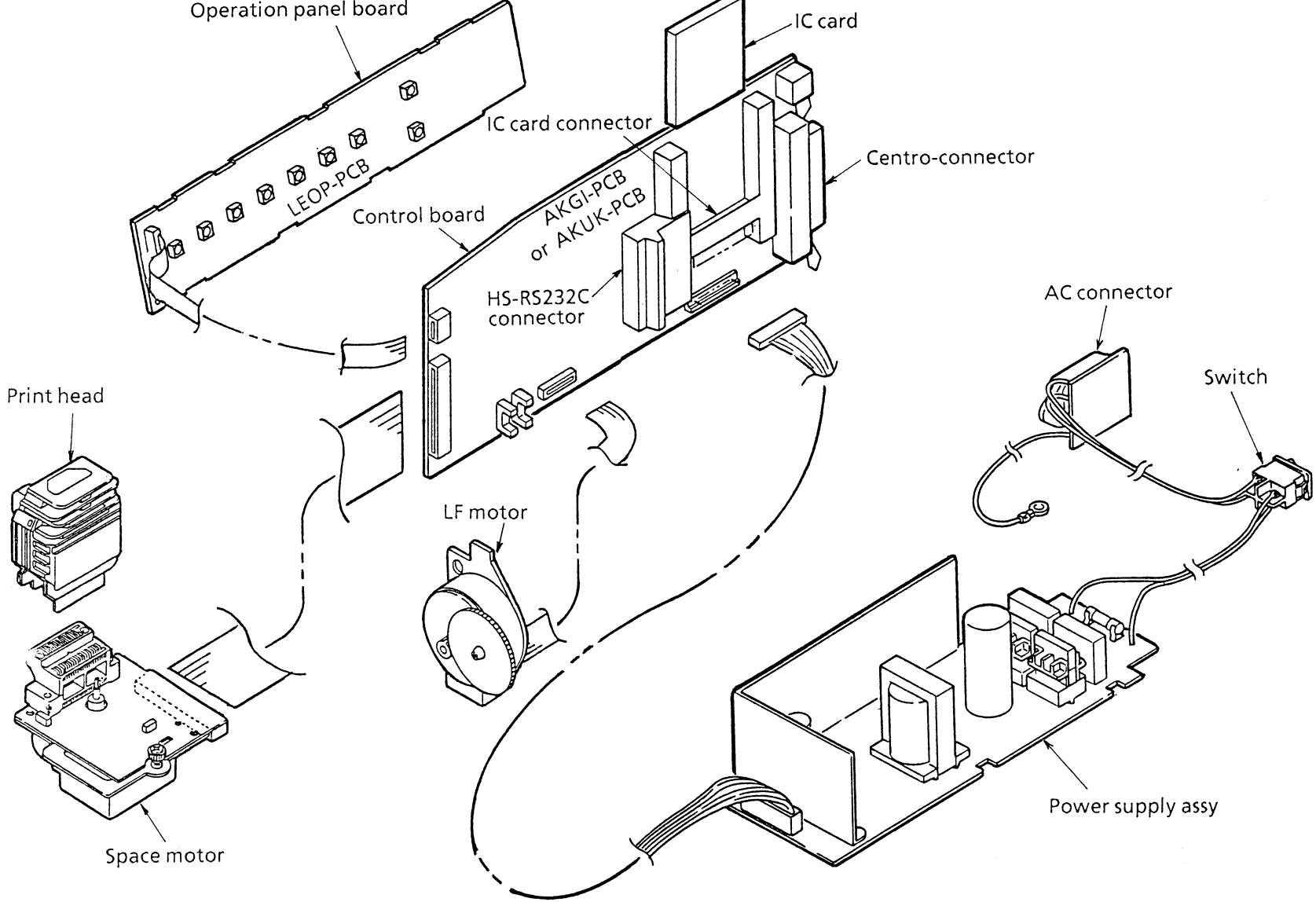
ALARM CATEGORY	ALARM	LED DISPLAY										REMARKS	TROUBLESHOOTING
		ALARM	10	12	15	17	20	PROP	UTILITY	PRESTIGE	BOLD		
MAIN CONTROL ALARM	MPU internal RAM alarm	◎	○									Read/write error	Replace Control Board
	Program ROM alarm	◎			○							Check sum error	Replace ROM or Control Board
	RAM on Control Board alarm	◎					○					Read/write error	Replace Control Board
	CG ROM alarm	◎			○					○		Check sum error	Replace CG ROM or Control Board
	EEPROM alarm	◎			○						○	No reaction when MPU reads data	Replace Control Board
FIRMWARE DETECTION ALARM	WDT (Watch Dog Timeout) alarm	◎				○						MPU is locked up and it is reset after 65ms.	Turn the power OFF and ON or replace Control Board
	NMI signal alarm	◎				○			○			NMI port of MPU is kept low level.	Replace Control Board
	BRK instruction alarm	◎				○				○		FFFF data is detected due to MPU locked up.	Replace ROM or Control Board
SERIAL INTERFACE ALARM	MPU internal RAM alarm	◎	○						○			Read/write error	Replace I/F Board
	ROM alarm	◎			○				○			Check sum error	Replace ROM on I/F board or I/F Board
	RAM on I/F board alarm	◎					○		○			Read/write error	Replace I/F Board
	I/F not mounted	◎		○					○			No reaction from serial I/F board	Replace I/F Board or Control Board.

◎ : LED Blink (200ms ON, 200ms OFF)
○ : LED Lights up.

ALARM CATEGORY	ALARM	LED DISPLAY										REMARKS	TROUBLESHOOTING
		ALARM	10	12	15	17	20	PROP	UTILITY	PRESTIGE	BOLD		
OPTION CARD ALARM (Note)	Option card is removed	◎		○						○		Card is removed during the card is accessed.	Turn the power OFF and ON or replace card or Control Board
	Option RAM card alarm	◎					○			○		Read/write error.	Replace the card or Control Board
SPACING ALARM	Spacing alarm	◎						○	○			Space IPT is not occurred within in specified timing.	• Replace space motor. • Replace P.H. cable. • Replace Control Board • Check the mechanism if load is too much.
	Print Head homing alarm	◎						○		○		Print head does not reach to the home position.	
PRINT HEAD ALARM	Print Head A/D alarm	◎	○				○					Thirmister is open, short with 0V or short with + 5V.	• Check the P.H. connection. • Replace Print Head. • Replace P.H. cable. • Replace Control Board
	Print Head Gap 1 alarm	◎	○				○		○			Self adjust was not successful. (Print head pin data error)	
	Print Head data transfer alarm	◎	○				○			○		Parity error was not recovered or P.H. is not mounted	
	Print Head type alarm	◎	○					○				9 pin P.H. is mounted on 24 pin printer. (Print head is not mounted or fault)	
	Reserve	◎	○					○	○			Drive current is detected during no over drive signal.	
	Print Head connection alarm	◎	○					○		○		Over drive signal is active but no current is detected.	
	Print Head Gap 2 alarm	◎	○				○				○	Self adjust was not successful. (Gap is too wide or too narrow.)	
DRIVER ALARM	LF/SP driver alarm	◎	○				○	○				TSD signal is not changed (Driver keeps high temperature.)	• Replace Control Board • Replace space motor or LF motor.

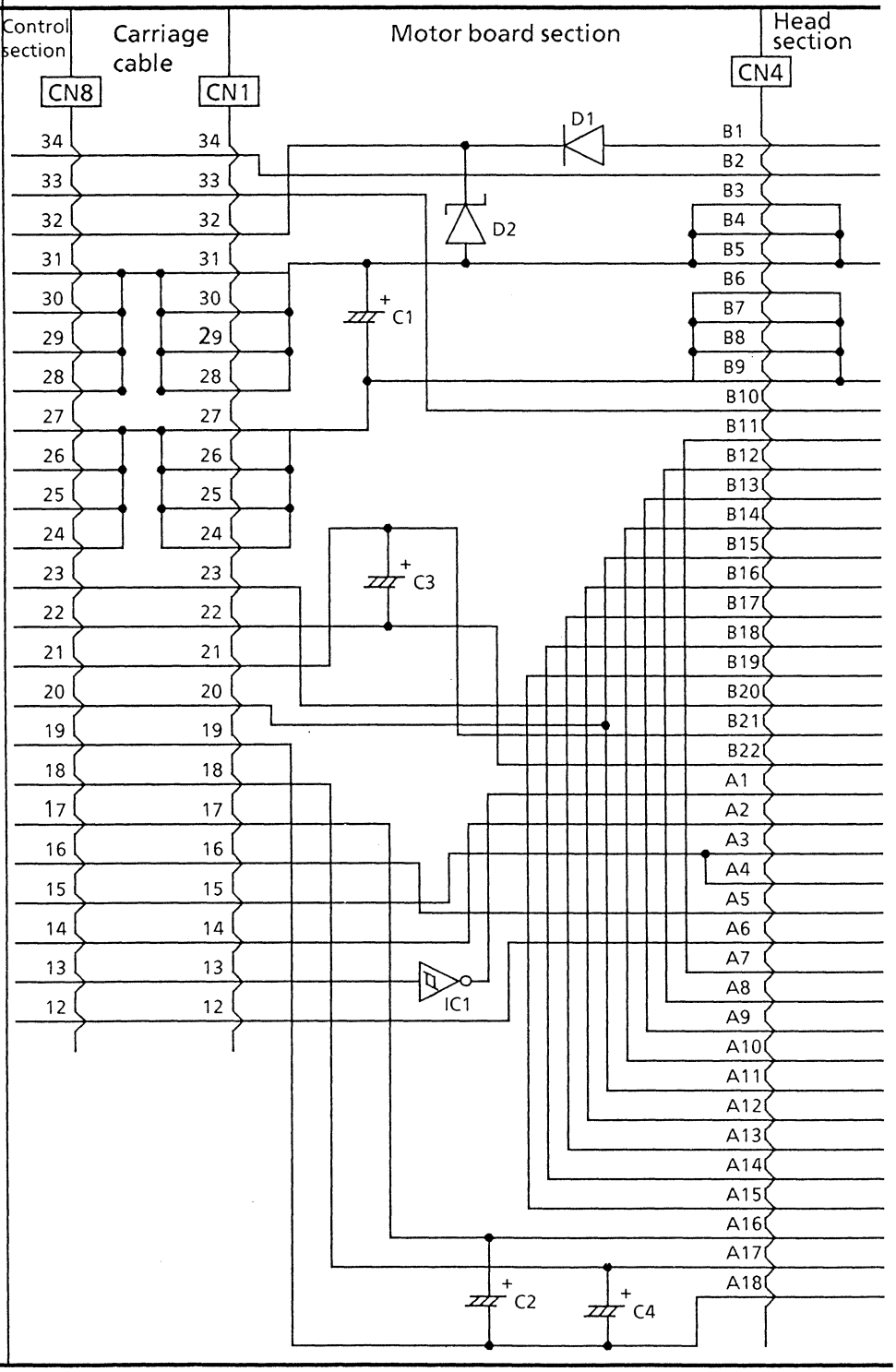
Note : Option card ALARM is appeared only for OEL version.

◎ : LED Blink (200ms ON, 200ms OFF)
○ : LED lights up.


Operation panel board
IC card
IC card connector
Centro-connector
LEOP-PCB
AKGI-PCB
or AKUK-PCB
Control board
HS-RS232C
connector
AC connector
Switch
Print head
LF motor
Space motor
Power supply assy

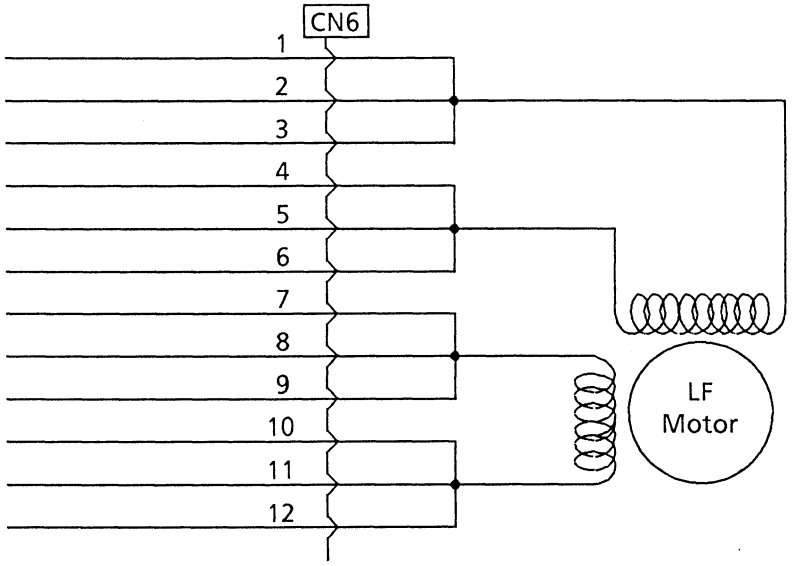
7.4 Connection Circuit Check for Printhead and SP/LF Motor

(1) Printhead

Signal	Connector pin number
ALM-O ALM-E 40VFS 40V 40V 40V 40V EP EP EP EP TSD EL 5V RST-N ELS 10V 5VS HDSLT-N HDSDATA-N HDSCLK-N CLK ERR	

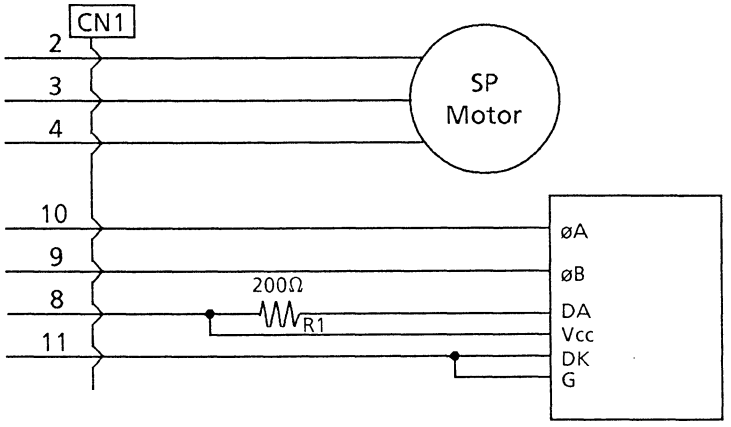
(2) Line Feed Motor

Resistance of each coil should be about 13Ω.

Pin number of LF Motor	Signal	Connector pin number
1	LF1	
2	LF1	
3	LF1	
4	LF2	
5	LF2	
6	LF2	
7	LF3	
8	LF3	
9	LF3	
10	LF4	
11	LF4	
12	LF4	

(3) Space Motor

Resistance of each coil should be about 5Ω.

Pin number of SP Motor	Signal	Connector pin number
2	SP-U	
3	SP-V	
4	SP-W	
10	PHASE-A	
9	PHASE-B	
8	+ 5V	
11	EL	

7.5 Troubleshooting flow chart

① (Power is not supplied.)

- Is the AC cable connected correctly?

Yes No

- Connect the AC cable correctly.

- Is fuse F1 and/or F2 120V system only on the power supply assy blown?

No Yes

- Replace fuse (s) (with same type and rating).
- Remedied?

No Yes

- End

- Remove carriage cable from CN8 on Control Board, then turn the power on.
  Do LEDs on operation panel light up?

No Yes

- Remove Print Head. (Turn power off, then on.)
- Remedied?

No Yes

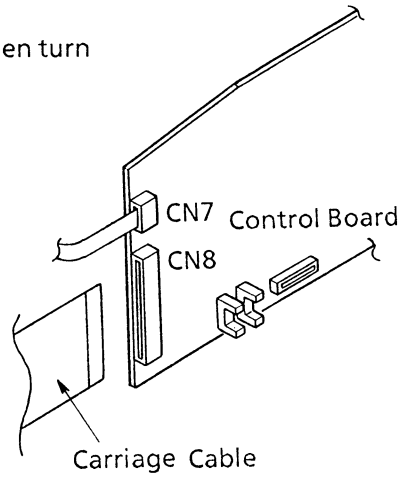
- End

- Replace carriage cable or ribbon feed mechanism.
- Remedied?

No Yes

- End

- Replace Control Board



- Remove CN3 on Control Board
- Measure for any short circuits between + 5V, + 40V, + 8V, 0V (EL or EP).
- Any short circuit?

No Yes

No Yes

- Replace Control Board

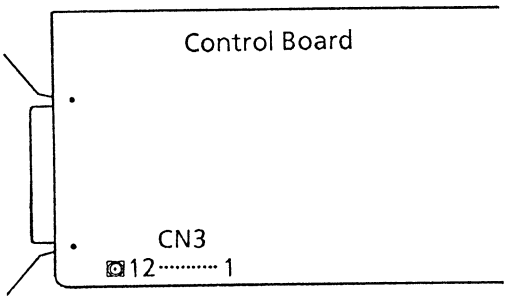
- Replace power supply assembly.

- Remedied?

No Yes

- End

- Replace operation panel.



Pin No.	12	11	10	9	8	7	6	5	4	3	2	1
Signal	ALM	-8V	+8V	+12V	EL (øV)		+5V		EP (F.G)		+40V	

② (No spacing operation) (The alarm LED blinks)

- Is carriage assembly binding or jammed?

No Yes

- Check around space motor to repair the mechanism of space rack, back up roller, ribbon feed mechanism, and carriage frame etc.

- Is fuse F1 on the Control Board blown?

No Yes

- Replace Control Board
- Remedied?

No Yes

- End

- Replace space motor.
- Remedied?

No Yes

- End

- Replace Control Board
- Remedied?

No Yes

- End

- Replace carriage cable.

③ Homing does not end normally.

- Does ALARM LED blink?

No Yes

- See tables 7.2 and 7.3 for the troubleshooting information.

- Does the carriage assy move left and right smoothly by hand?

Yes No

- Check around space motor to repair the mechanism.
  (Space rack, ribbon feed assembly back up roller, carriage frame, support protector and ribbon protector.)
- Remedied?

No Yes

- End

- Replace space motor assembly.

- Does the carriage assy move a little bit to the right after turning power is on?

No Yes

- Replace carriage cable.
- Remedied?

No Yes

- End

- Replace Control Board
- Remedied?

No Yes

- End

- Replace space motor assy.

- Replace space motor assembly.
- Remedied?

No Yes

No Yes

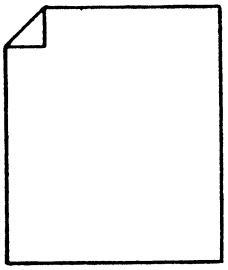
- End
- Replace Control Board
- Remedied?

No Yes

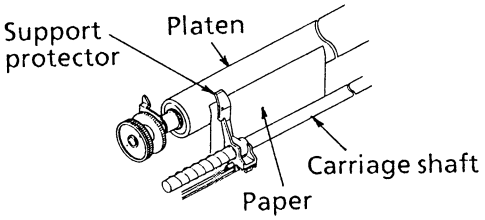
- End
- Replace carriage cable.

④ Paper jam while paper insertion

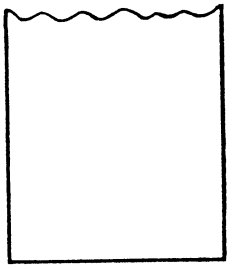
Jam 1 (Dog ear)



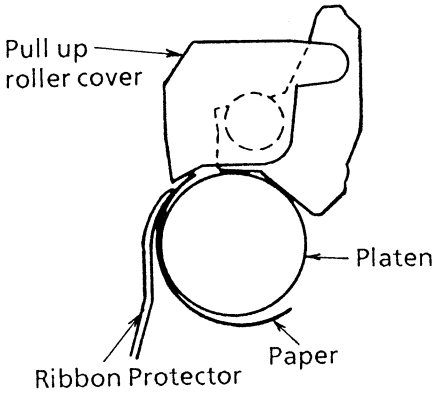
- Check the support protector if it covers left side of paper properly, or whether paper is inserted properly.



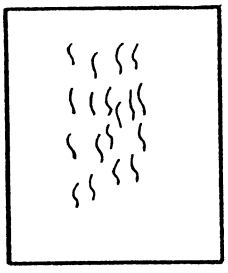
Jam 2



- Check the ribbon protector.
- Check the pull up roller cover is closed properly.



Jam 3 (wrinkled paper)



- Check around pressure roller mechanism.
  - ◦ Front pressure springs are (ML590 : 3pcs ; ML591 : 5pcs) mounted properly or not.
  - ◦ Tension of all of front pressure rollers are same or not

$$\left\{\begin{array}{l}\text{380g for TOP position}\\ \text{90g for rear position}\end{array}\right\}$$

  - ◦ Make sure of the fitting position of front release gear arm and gear of front release gear shaft are correct.

⑤ Smearing/Missing Dots

- Does ALARM LED blink and display alarm?

No Yes

- See tables 7.2 and 7.3 for troubleshooting information.

- Replace print Head.
- Remedied?

No Yes

- End

- Replace Control Board
- Remedied?

No Yes

- End

- Replace carriage cable or space motor assembly.

⑥ Faint or dark print

- Is the print head gap set properly?

Yes No

- Adjust the print head gap (See section 5)
- Remedied?

No Yes

- End

- Turn the power on and measure the Head gap
- Is the Head gap indicator display range 9?

Yes No

- Replace ribbon feed mechanism.
- Remedied?

No

- Replace Control Board

- Replace print Head.
- Remedied?

No Yes

- End

- Replace Control Board

⑦ Ribbon feed trouble

- Remove the ribbon cartridge.
- Move carriage to left and right.
- Does the ribbon drive shaft rotate?

No Yes

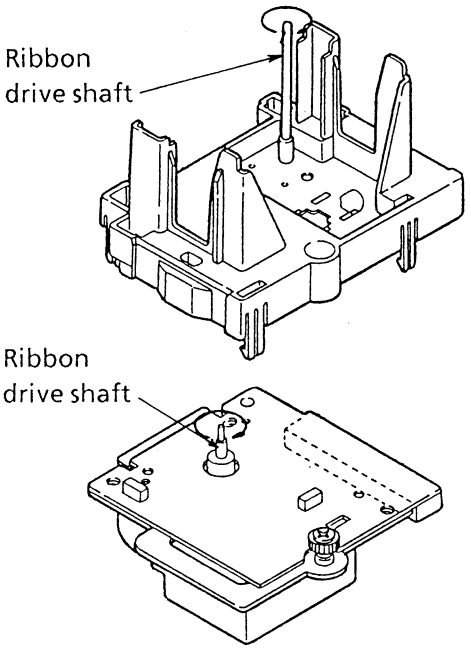
- Change ribbon cartridge.

- Remove ribbon feed mechanism.
- Move carriage to left and right.
- Does the ribbon drive shaft rotate?

No Yes

- Replace ribbon feed mechanism

- Replace space motor assembly.



⑧ Line feed trouble

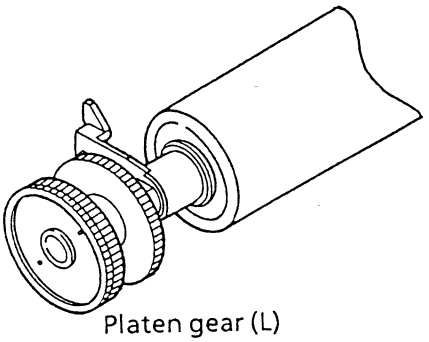
- Turn the power off, and rotate the platen manually.
- Does the platen rotate smoothly?

Yes No

- Is the platen gear (L) broken?

No Yes

- Replace platen assembly.



Platen gear (L)

- Is the LF idle gear broken?

No Yes

- Replace LF motor assembly or LF idle gear.
- Is the platen gear (L) and/or idle gear, change gear broken?

No Yes

- Replace the gear.
- Set change lever to the rear position.
- Does the platen rotate smoothly?

No Yes

- Replace tractor feed assembly.
- Replace LF motor assembly.
- Replace LF motor assembly.
- Remedied?

No Yes

- End
- Replace Control Board

⑨ Malfunction of switch on operation panel

- Is the CN1 of operation panel connected to the CN7 on the Control Board?

Yes — No

- Connect the cable properly.

- Replace operation Panel Board

- Remedied?

No — Yes

- End

- Replace Control Board

⑩ Data receiving failure

- Is the SEL LED blinking?

No Yes

- Printer went into the print suppress mode.
  Wait until printer to receives DC1 code, or change the menu item "Print suppress-Ineffective" when the function is not required.

- Is the I/F RS232C?

No Yes

- To step 10-2

- Does the SEL LED light up?

Yes No

- Press SEL key.
- Remedied?

No Yes

- Does the printer receive data properly?

No Yes

- To step 10-1
- End

10-1

- Disconnect I/F cable
- Does the SEL LED light up?

No Yes

- Change menu item I-prime to invalid, or check for defective cable.

- Replace Control Board
- Remedied?

No Yes

- End

- Replace I/F cable.

10-2 (RS 232C I/F)

- Is the correct cable used?

Yes No

- Change I/F cable.

- Is ALARM LED blinking?

No Yes

- See tables 7.2 and 7.3 for the trouble shooting.

- Make sure of the parameters for RS232C in the menu are correct.

  - Baud rate
  - Bit length
  - Parity
  - Protocol
  - Busy signal and its polarity

- Remedied?

No Yes

- End

- Is + 8V and – 8V supplied on Control Board?

Yes No

- Replace power supply assy
- Remedied?

No Yes

- End

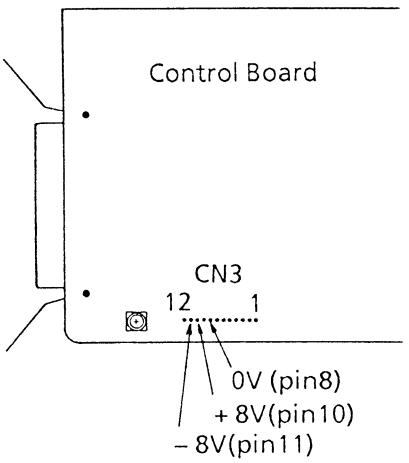
- Remove RS232C I/F Board
- Is the + 8V and – 8V supplied on the Control Board?

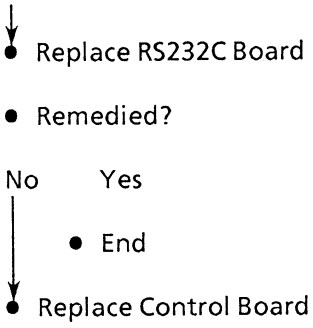
No Yes

- Replace RS232C I/F Board

- Replace Control Board

Printer I/F pin assignment.
TXD 2 pin,
RXD 3 pin,
SSD 11 pin,
DTR 20 pin,
DSR 6 pin.




Replace RS232C Board
Remedied?
No
Yes
End
Replace Control Board

APPENDIX A

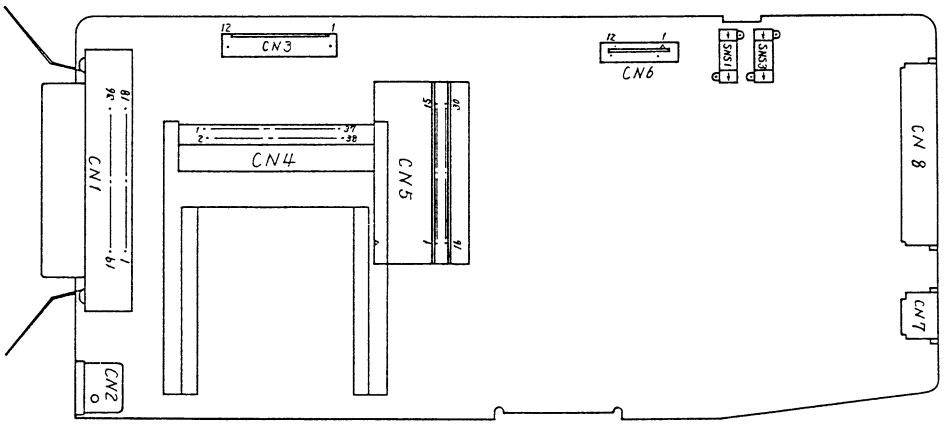
A. PCB LAYOUT

PCB list

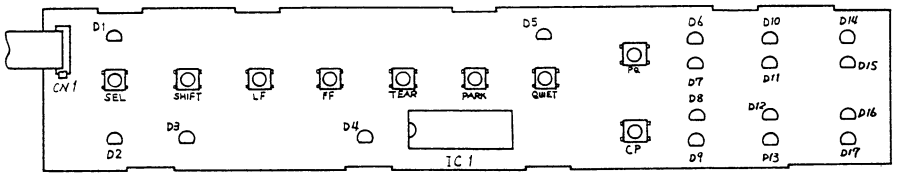
(1) Circuit board. AKGI-2 (Main controller)

(2) Circuit board. LEOP (Operator Panel)

(1)



(2)



APPENDIX B

B. CIRCUIT DIAGRAM

Figure B–1	Interconnect Signal Diagram
Figure B–2–1/5–5/5	Main controller PCB circuit diagram AKGI–2 Rev.7
Figure B–3–1/5–5/5	Main controller PCB circuit diagram AKGI–2 Rev.8
Figure B–4–1/6–6/6	Main controller PCB circuit diagram AKGI–2 Rev.9 AKUK–2 Rev.4
Figure B–7	Operator panel PCB circuit diagram LEOP–Rev.5
Figure B–8	Carriage circuit diagram
Figure B–9	Power supply circuit diagram (240V)

APPENDIX C

C. SPARE PARTS LIST

Quantity per year: Indicates the recommended number of each part that should be ordered for routine maintenance for one year for 500 units of printers and assuming that the printers are operated for 2 hours/day of 600 hours/year. The following codes are used to indicate the number of printers for which maintenance parts are ordered.

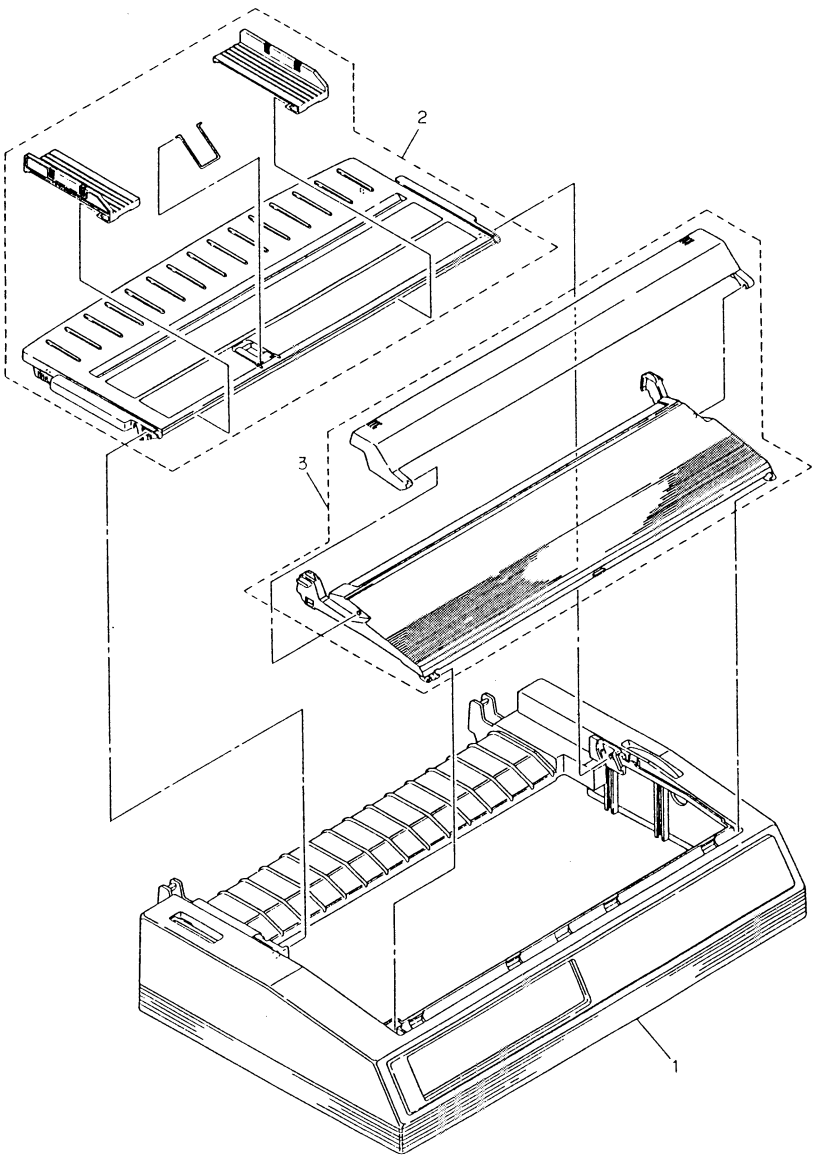


Figure 11-1 Upper Cover Assy

Figure 11-1 Upper Cover Assy

No.	Part No.	Description	Q'ty	Q'ty Required	Remarks
1.	1PP4094-6501P3	Upper cover (N)	1	3	For 590
	1PP4094-7201P3	Upper cover (W)	1	3	For 591
2.	1PA4094-7305G2	Sheet guide assy (N)	1	3	For 590
	1PA4094-7308G2	Sheet guide assy (W)	1	3	For 591
3.	2PA4094-7381G1	Access cover assy (N)	1	3	For 590
	2PA4094-7382G1	Access cover assy (W)	1	3	For 591

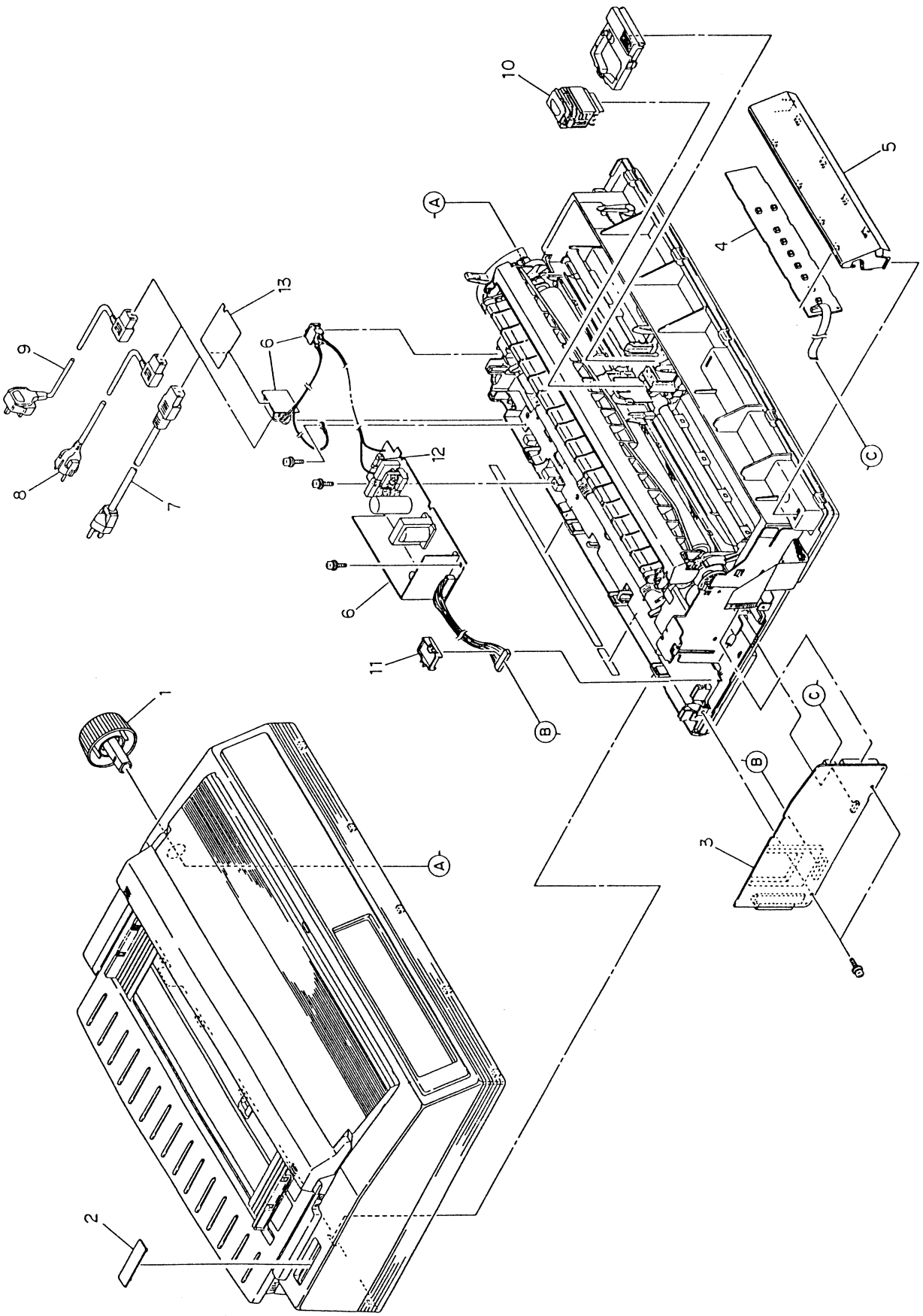


Figure 11-2 Printer general Assy

Figure 11-2 Printer general assy

No.	Part No.	Description	Q'ty	Q'ty Required	Remarks
1.	2PP4094-6507P3	Platen Knob	1	3	
2.	3PP4094-6505P2	Cover (A) for card slot	1	3	
3.	4YA4042-1514G401	Control board (AKGI-2)	1	3	Without ROM
	4YA4042-1527G401	Control board (AKUK-)	1	3	Without ROM for UK production
4.	4YA4042-1516G1	Operator panel board (LEOP-)	1	3	
5.	3PP4025-3670G3	Operation panel	1	3	
6.	4YB4049-1707P1	Power supply assy (590 120V)	1	3	For 590 120V
	4YB4049-1707P2	Power supply assy (591 120V)	1	3	For 591 120V
	4YB4049-1708P1	Power supply assy (590 230/240V)	1	3	For 590 230/240V
	4YB4049-1708P2	Power supply assy (591 230/240V)	1	3	For 591 230/240V
7.	3YS4011-1026P1	AC cord for 120V	1	1	For 120V
8.	3YS4011-1265P1	AC cord for 230V	1	1	Continental
9.	3YS4011-1268P1	AC cord for 240V	1	1	UK type
10.	4YA4023-2601G1	Print head assy	1	10	
11.	4PP4025-3621P1	Cord clamp	1	3	
12.	540A2036M1502	Fuse (GGS5) for 120V	1	10	For 120V
	4YB4021-1146P1	Fuse for 230/240V	1	10	For 230/240V
	540A2036M1252	Fuse (GGS2.5) for 120V	1	10	For 120V
13.	4PP4025-3671P1	Cord cover	1	3	

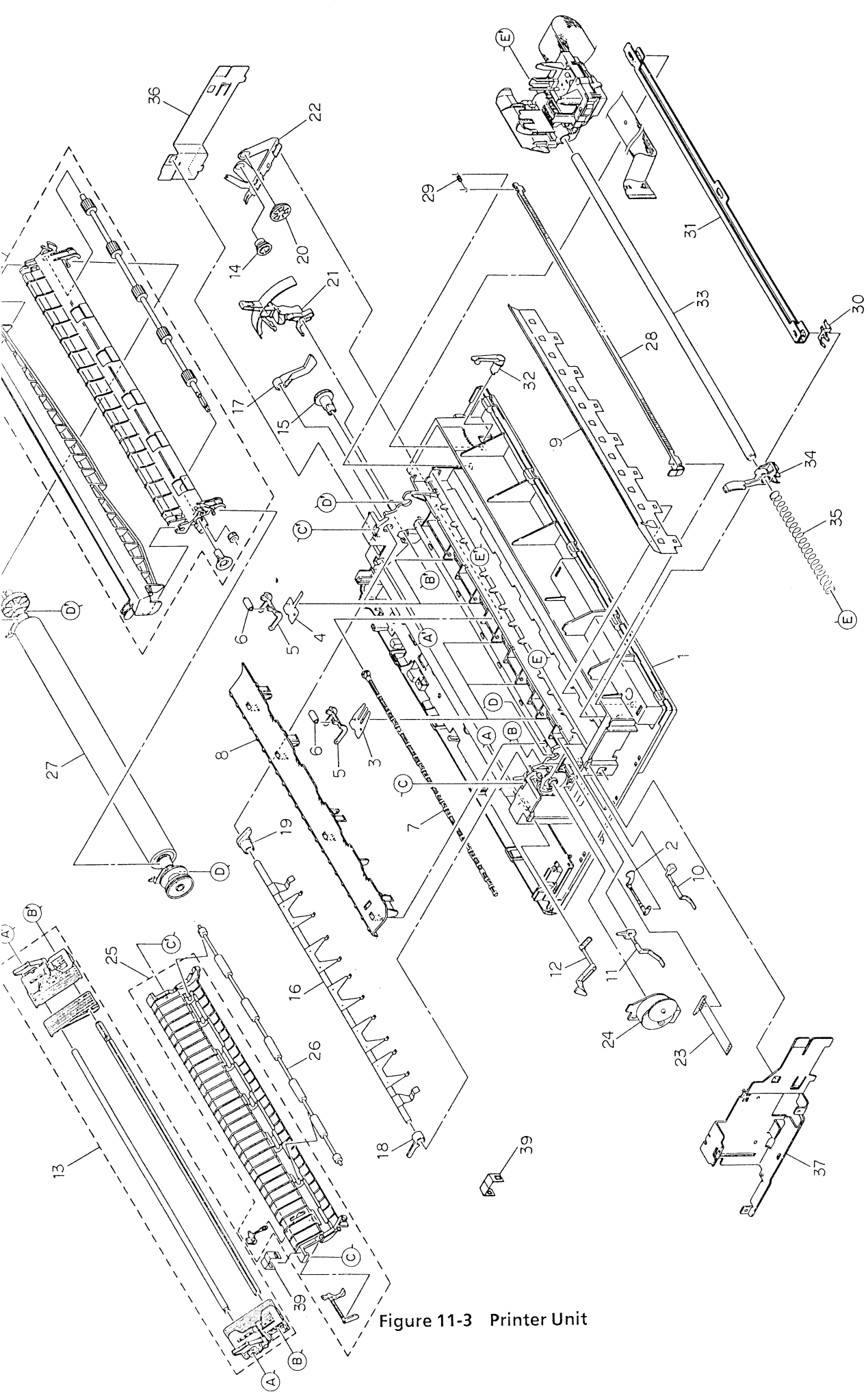


Figure 11-3 Printer Unit

Figure 11-3 Printer unit

No.	Part No.	Description	Q'ty	Q'ty Required	Remarks
1.	3PA4025-3302G1	Main frame (N)	1	3	For 590
	3PA4025-3502G1	Main frame (W)	1	3	For 591
2.	3PP4025-3315P1	Bottom paper end lever	1	3	
3.	4PP4025-3316P1	Front pressure spring	3	3	
4.	4PP4025-3324P1	Front pressure spring(W)	2	2	For 591
5.	4PP4025-3317P1	Front roller holder	3	9 (590) 15 (591)	
6.	4PP4025-3325P1	Front pressure roller	3	9 (590) 15 (591)	
7.	3PP4025-3318P1	Front release gear shaft (N)	1	3	For 590
	3PP4025-3505P1	Front release gear shaft (W)	1	3	For 591
8.	1PP4025-3319P2	Paper pan (N)	1	3	For 590
	1PP4025-3506P2	Paper pan (W)	1	3	For 591
9.	3PP4025-3320P1	Leaf spring (N)	1	3	For 590
	3PP4025-3507P1	Leaf spring (W)	1	3	For 591
10.	3PP4025-3322P1	Bottom sensor lever	1	3	
11.	3PP4025-3321P1	Rear sensor lever	1	3	
12.	4PP4025-3323P1	Sensor lever for cut sheet & continuous sheet	1	3	
13.	3PA4025-3330G1	Tractor assy (N)	1	3	For 590
	3PA4025-3330G2	Tractor assy (W)	1	3	For 591
14.	4PP4025-3340P1	Change gear	1	3	
15.	3PP4025-3341P1	Tractor gear	1	3	
16.	3PP4025-3346G1	Pressure spring (N)	1	3	For 590
	3PP4025-3511G1	Pressure spring (W)	1	3	For 591
17.	4PP4025-3350P1	Front release gear arm	1	3	
18.	4PP4025-3351P1	Switch lever (cut sheet & continuous sheet)	1	3	

No.	Part No.	Description	Q'ty	Q'ty Required	Remarks
19.	3PP4025-3352P1	Release cam	1	3	
20.	4PP4025-3353P1	Idle gear	1	3	
21.	2PP4025-3354P3	Change lever	1	3	
22.	3PP4025-3355P1	Reset spring	1	3	
23.	3PB4025-3356P1	LF connection cord	1	5	
24.	3PB4025-3357P1	LF motor assy	1	5	
25.	3PA4025-3360G2	Paper chute assy (N)	1	3	For 590
	3PA4025-3515G2	Paper chute assy(W)	1	3	For 591
26.	3PB4025-3364P1	Rear pressure roller (N)	1	3	For 590
	3PB4025-3517P1	Rear pressure roller (W)	1	3	For 591
27.	3PA4025-3370G1	Platen assy (N)	1	3	For 590
	3PA4025-3370G2	Platen assy (W)	1	3	For 591
28.	3PP4025-3376P1	Space rack(N)	1	5	For 590
	3PP4025-3522P1	Space rack(W)	1	5	For 591
29.	4PB4025-3377P1	Tension spring for space rack	1	3	
30.	4PP4025-3378P1	Guide rail FG SP(L)	1	1	
31.	3PP4025-3379P1	Guide rail(N)	1	1	For 590
	3PP4025-3523P1	Guide rail(W)	1	1	For 591
32.	3PP4025-3380P1	Adjust cam	1	3	
33.	4PP4025-3381P1	Carriage shaft(N)	1	3	For 590
	4PP4025-3381P2	Carriage shaft(W)	1	3	For 591
34.	4PA4025-3382G1	Support protector assy	1	3	
35.	4PB4025-3385P1	Support protector reset spring	1	3	
36.	3PP4025-3386P1	FG plate (R)	1	1	
37.	3PA4025-3387G1	FG plate (L) assy	1	1	
38.	3PA4025-3440G2	Pull-up roller assy (N)	1	3	For 590
	3PA4025-3530G2	Pull-up roller assy (W)	1	3	For 591
39.	4PP4025-3365P1	Lock spring	1	1	

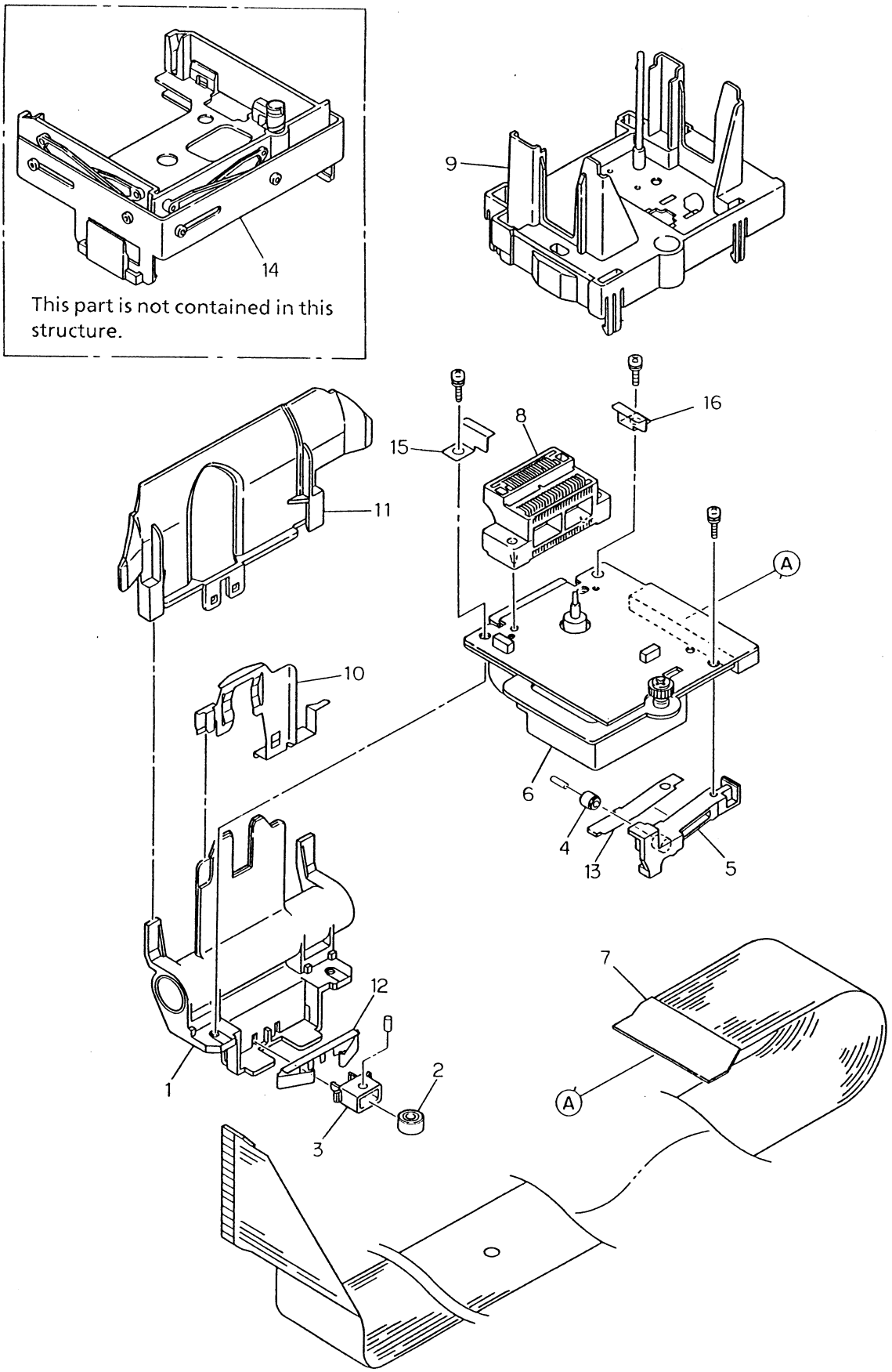
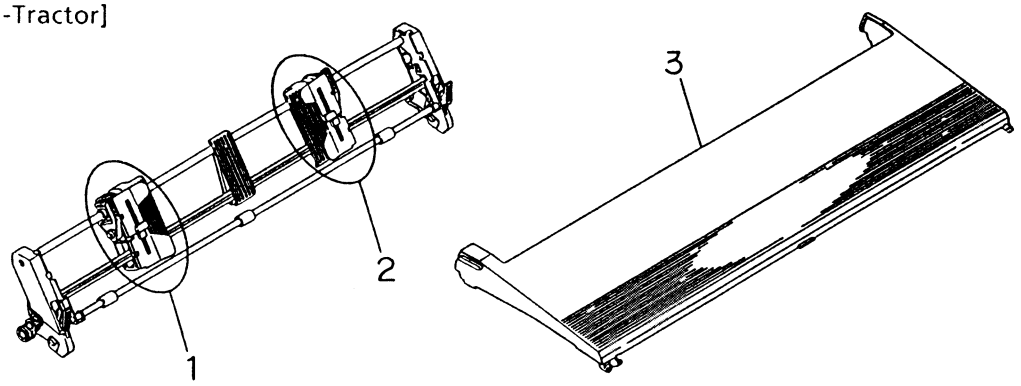


Figure 11-4 Carriage assy

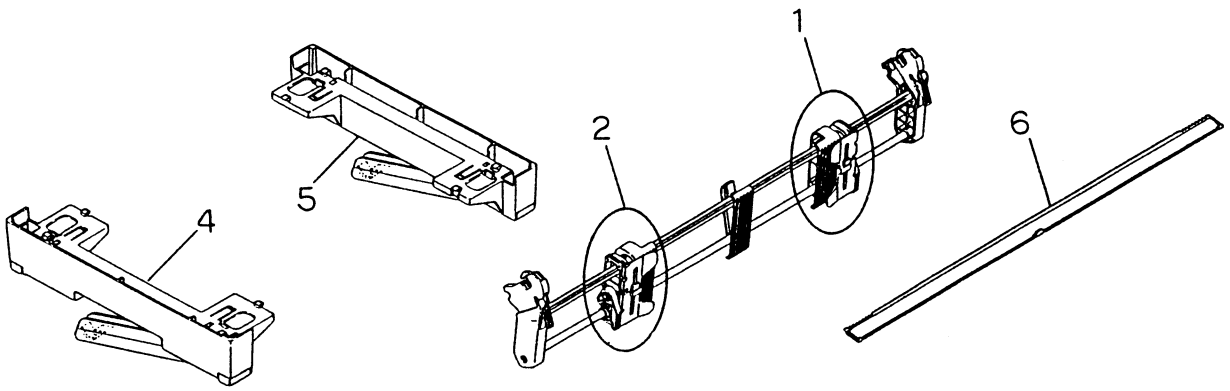
Figure 11-4 Carriage option assy

No.	Part No.	Description	Q'ty	Q'ty Required	Remarks
1.	4PP4025-3394G1	Carriage frame set	1	3	
2.	4PP4025-3392P1	Back up roller	1	3	
3.	3PP4025-3393P1	Back up roller holder	1	3	
4.	4PP4025-3398P1	Guide roller	1	3	
5.	3PP4025-3399P1	Guide roller holder	1	3	
6.	4YA4025-3250G1	space motor assy	1	5	
7.	2PU4007-1193P1	Carriage cable(N)	1	10	For 590
	2PU4007-1193P2	Carriage cable(W)	1	10	For 591
8.	224A1285P0400	PC connector	1	3	
9.	3PA4025-3406G1	Gear case assy	1	3	
10.	3PP4025-3431P1	Head clamp	1	3	
11.	3PP4025-3430P1	Ribbon protector	1	5	
12.	4PP4025-3397P1	Back-up roller holder spring	1	3	
13.	4PP4025-3401P1	Guide roller spring	1	3	
14.	3PA4025-3581G1	Colour Shift Unit	1	3	(Option)
15.	4PP4025-3433P1	Connector holder (L)	1	1	
16.	4PP4025-3434P1	Connector holder (R)	1	1	

[Pull-Tractor]



[Bottom-Tractor]



[I/F Board]

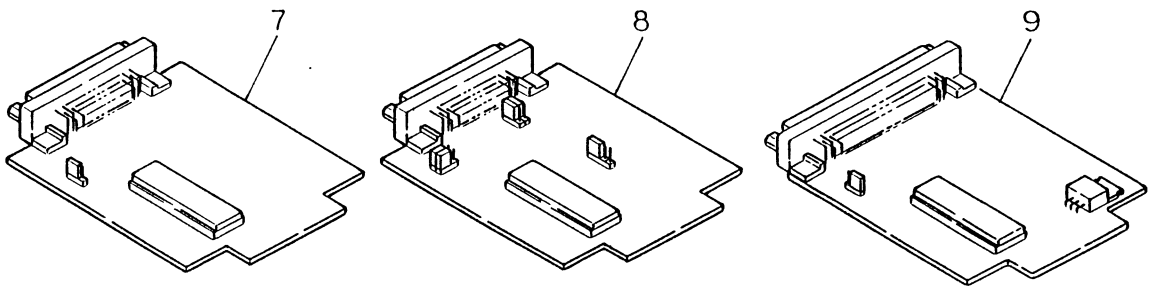


Figure 11-5 Option spare parts

Figure 11-5 Option spare parts

No.	Part No.	Description	Q'ty	Q'ty Required	Remarks
1.	4PA4025-3608G1	Pull and bottom tractor assy(L)	1	3	
2.	4PA4025-3603G1	Pull and bottom tractor assy(R)	1	3	
3.	2PP4094-7383G1	Tractor cover assy(N)	1	3	For 590
	2PP4094-7384G1	Tractor cover assy(W)	1	3	For 591
4.	2PA4094-6510G4	Bottom push stand(L)	1	3	
5.	2PA4094-6510G3	Bottom push stand(R)	1	3	
6.	4PP4094-7385G1	Paper knife(N)	1	3	For 590
	4PP4094-7386G1	Paper knife(W)	1	3	For 591
7.	4YA4021-1050G1	LXHI-PCB(RS232C I/F)	1	3	
8.	4YA4021-1106G2	LXCL-PCB(Current roop I/F)	1	3	
9.	4YA4021-1102G3	LXHA-PCB(RS422 I/F)	1	3	